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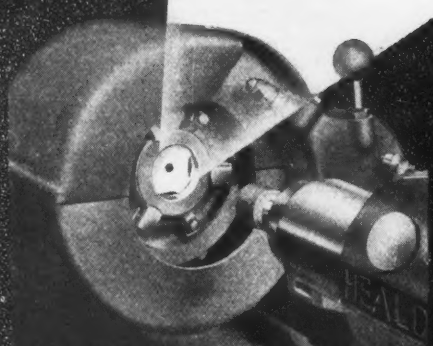

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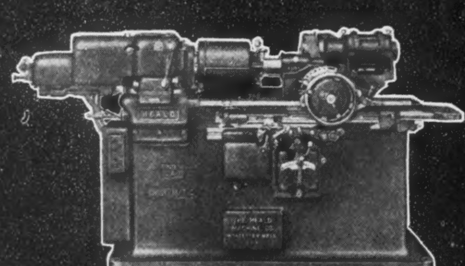

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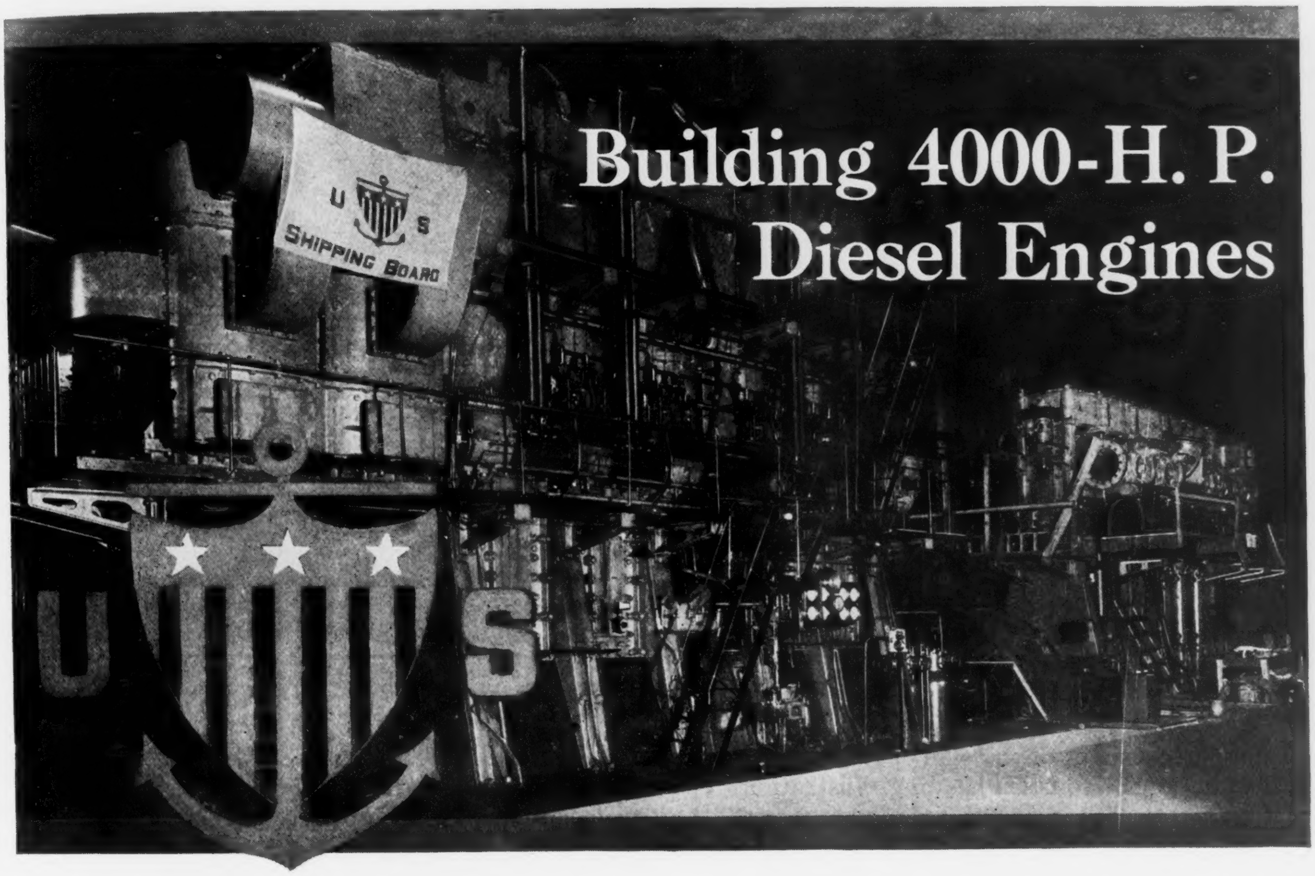


Building 4000-H. P. Diesel Engines

The Largest Diesel Engines Ever Constructed in This Country have Been Built for Propelling 10,000-ton Vessels Operated by the U. S. Shipping Board

By CHARLES O. HERB

ENGINES of the Diesel type are being increasingly adopted for land and marine use because of their unsurpassed fuel economy. On freight-carrying vessels and passenger liners this advantage is particularly important, since it results in substantially lower operating costs and increased cargo capacity. The space required for fuel on a Diesel engine driven craft is only about 25 per cent of that necessary for the fuel of a coal-burning vessel of similar capacity. Even in comparison with an oil-burning steamship, the fuel for a Diesel engine would occupy only 60 per cent of the space required for the former.

Diesel engines are considerably smaller in size than other types of engines having the same horsepower rating. Engine and fuel space are vital factors in the design of submarines, and it is small wonder then that Diesel engines have been universally adopted for propelling these boats. Hundreds of Diesel engines have been built by Germany for this class of service.

European concerns first gained prominence in building engines of the Diesel type because of the fact that they originated in Germany. However, American companies have been rapidly coming to the fore in recent years by applying American methods in the building both of engines under foreign license, and those of American design. Great strides have been made in the construction of Diesel engines of large capacity. Two Diesel engines of 4000 horsepower each—the largest ever built in this country—have recently been produced by the Hooven, Owens, Rentschler Co., Hamilton, Ohio, a concern that has established an enviable record in the building of stationary and marine engines of various types over a period of fifty years.

These 4000 horsepower Diesel engines were built for the United States Shipping Board for driving two new 10,000-ton freight vessels. The vessels are intended for round-the-world service, and have a direct drive from the engines.

Two Thousand Drawings are Required in Building these Mammoth Power Producers

Each of these engines has over 10,000 parts, and was built from a total of more than 2000 drawings. The price per engine was $300,000. The engines are of the four-cylinder, two-cycle, double-acting type, and weigh approximately 400 tons each. They measure about 30 feet in length and 28 feet in

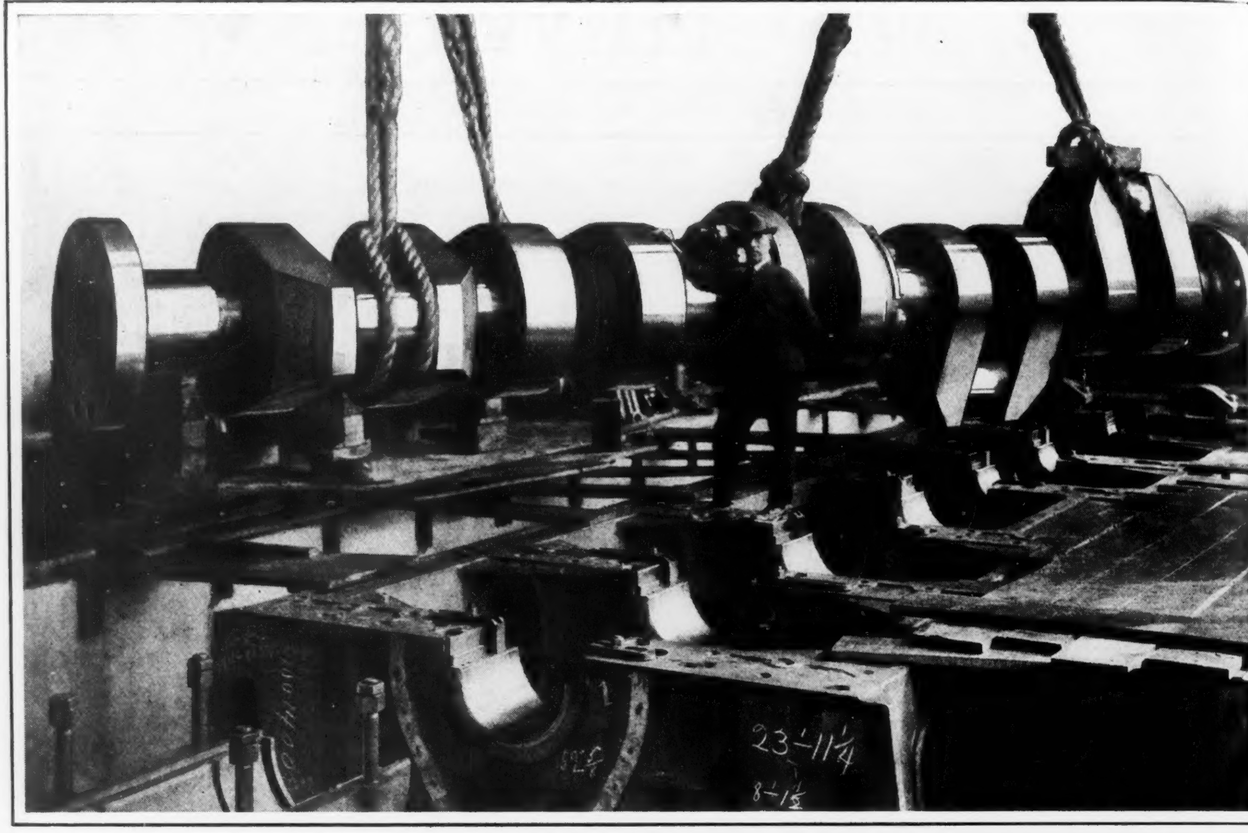


Fig. 1. Crankshaft for the Largest Diesel Engine Ever Constructed in the United States—The Crankshaft Weighs 77,000 Pounds

height; an excellent impression of their proportions can be obtained from the heading illustration. The cylinders are 27 1/2 inches in diameter, and the pistons have a stroke of 47 1/4 inches. On every piston, the combustion load is approximately 300-000 pounds. Some of the individual parts are of tremendous weight, the crankshaft weighing 77,000 pounds, or 38 1/2 tons, and the bed plate, 66,000

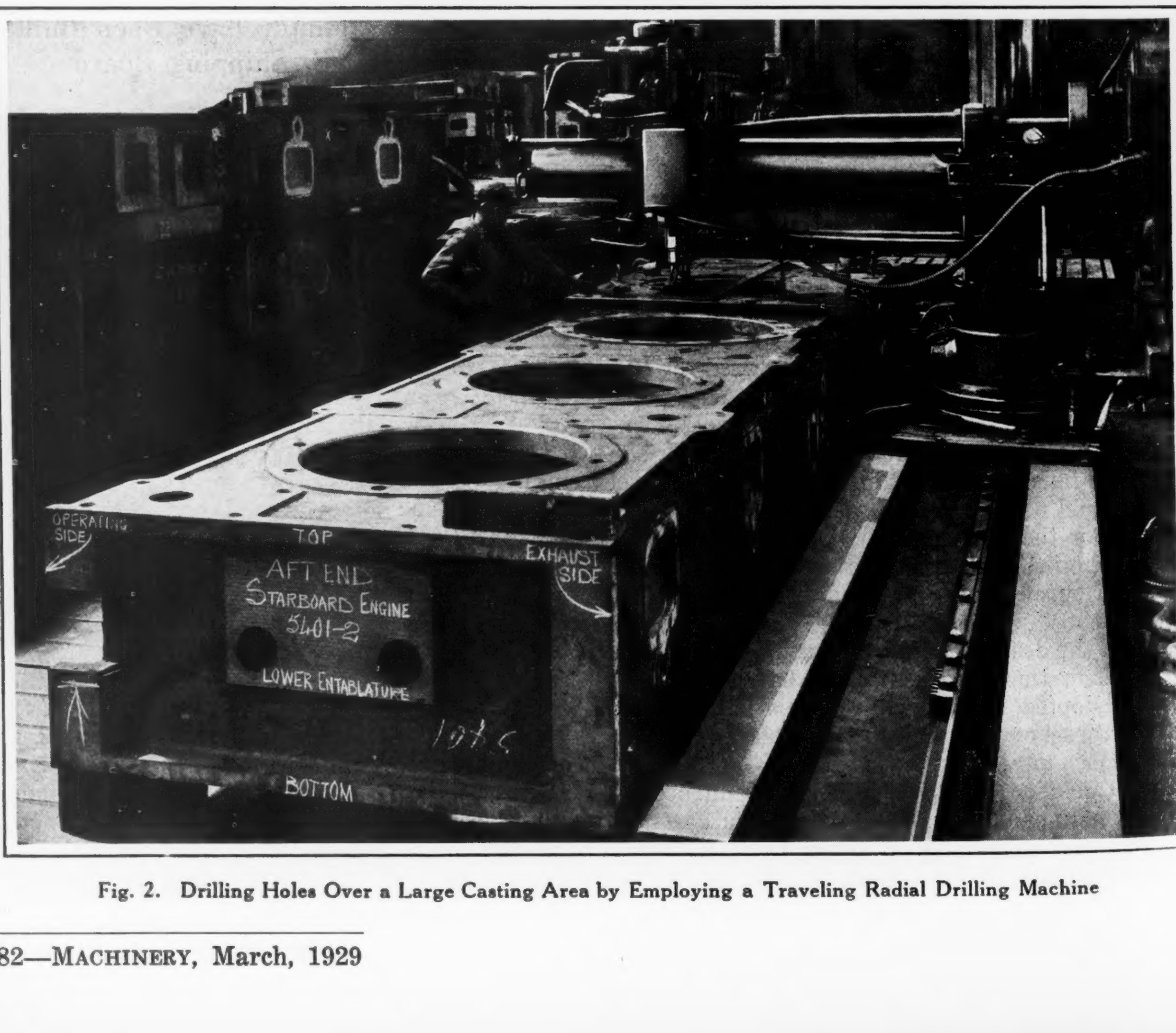


Fig. 2. Drilling Holes Over a Large Casting Area by Employing a Traveling Radial Drilling Machine

pounds or 33 tons. The 4000 horsepower is developed at a crankshaft speed of 110 revolutions per minute.

Very Close Limits of Accuracy are Maintained on these Huge Parts

Accuracy of an unusually high degree for such large work must be obtained in machining the principal functioning parts of these mammoth engines. For example, the crankpins must be ground to size within plus or minus 0.001 inch on a diameter of 19 3/4 inches. The allowed deviation in the center-to-center distance between the main bearings and the cr. nkpins is only 0.0025 inch on a specified length of 60 inches.

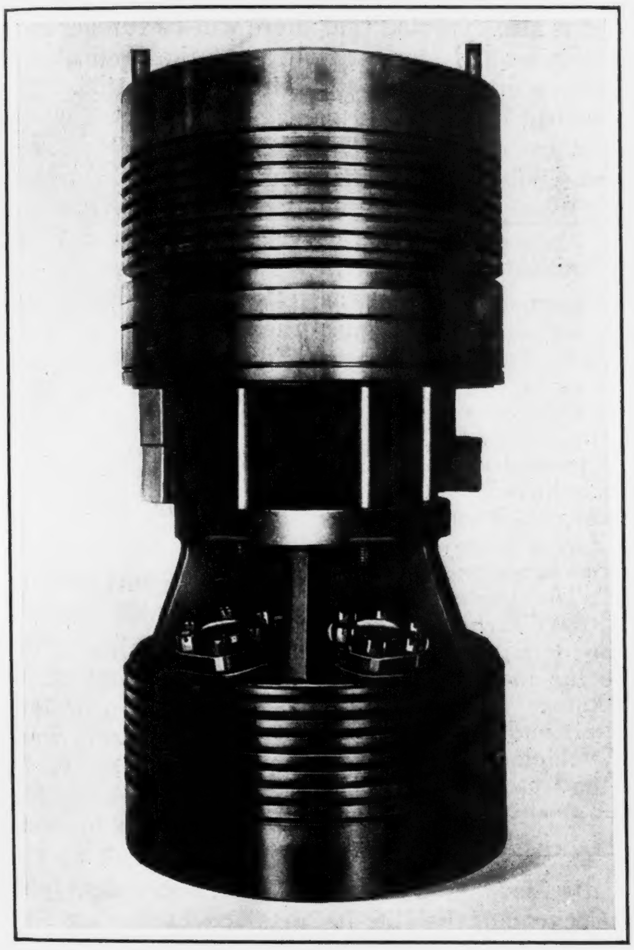


Fig. 3. Piston of Double-acting Design which Takes a Combustion Load of 300,000 Pounds

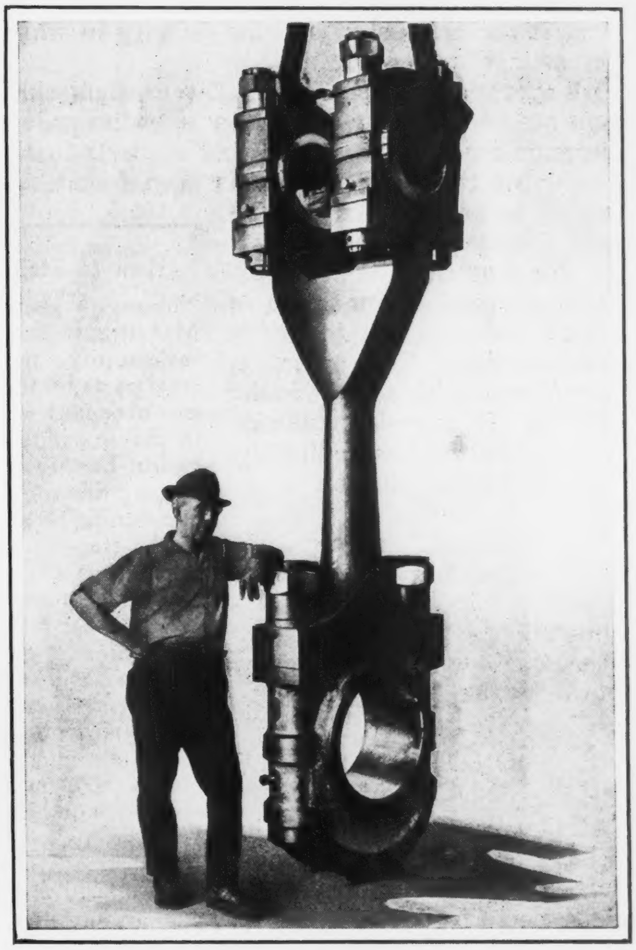


Fig. 4. Connecting-rod Measuring about Ten Feet between Centers and Weighing 8000 Pounds

Fig. 1 shows the crankshaft for one of these engines. It has an over-all length of 28 feet and must be machined in a lathe of at least 86-inch swing. The crankshaft is made in two main sections, which are machined separately, except for the main bearings. These bearings are finished after the two sections have been bolted together. Both the main bearings and the crankpins are ground.

The bearings in the bedplates for the crankshafts are bored with one setting of these castings on the bed of a heavy lathe. A boring-bar driven from the lathe spindle is employed, one bearing being finished at a time. The bearing caps are assembled prior to this operation, and are thus bored simultaneously with the bearings.

The cylinders are made in two sections, and their diameter of 27 1/2 inches must be true to size within minus 0.000 and plus 0.004 inch. They must be parallel witin very close limits for the entire length of approximately 7 feet. Pistons of the design illustrated in Fig. 3 operate in the cylinders. These are of a double-acting design, having upper and lower sections. Material that stands up well under the high temperatures met with in Diesel engine service must be used for the pistons. The exhaust temperature of these Diesel engines is about 500 degree F., which means that the temperature at the pistons must be between 800 and 1000 degrees F. The pistons, cylinder heads and cylinder linings are water-cooled to enable these parts to withstand the high temperatures to which they are subjected. The pistons weigh 2000 pounds, and are equipped with split hammered rings.

The Connecting-rods Weigh Four Tons Each

Fig. 4 shows one of the connecting-rods—the distance between the centers of the bores is 10 feet. These connecting-rods are made up of a forged-steel central piece or arm and cast-steel boxes and caps having babbitted linings. The steel castings are fastened to the arm by 5 3/8-inch bolts. The bolts are fitted snugly into holes reamed closely in line with each other so as to eliminate any tendency to twist the bolts. The weight of each complete connecting-rod is 8000 pounds or four tons. The lower end of the connecting-rods, as illustrated, is fitted to one of the crankpins, while the upper end is attached to a cross-head. The latter is connected to the rod of the corresponding piston.

Unusually Varied Facilities are Required for Building Such Large Engines

For the building of large Diesel engines, plants must be equipped with both heavy and light types of machine tools. Heavy parts, such as the crankshafts, bedplates, connecting-rods, cross-head guide housings, and cylinder blocks, naturally require planers, milling machines, boring mills, lathes, and drilling machines of large capacity and powerful design. However, the thousands of smaller parts used in the construction of the engines must be finished on smaller machines of the same general types. Cranes having capacities up to 50 tons must be available for transporting the various parts about the machine shop and the foundry in which the castings are produced.

All operations in the Hooven, Owens, Rentschler plant are carried out with a view to reducing to a minimum amount the hand-fitting of parts in the erection of the engines. It has been found economical to provide jigs and fixtures for parts of which only a few are required. Fig. 2 illustrates a typical jig employed in drilling holes in the top of a frame casting. This operation is performed with a large radial drill that is moved lengthwise on a long bed for positioning the drill spindle over the top of the casting.

These Diesel engines and others of smaller size are built under the license of the Maschinenfabrik-Augsburg-Nürnberg Co., Augsburg, Germany, known as the M.A.N. Co.

* * *

EXPANSION OF AUTOMOBILE INDUSTRY

At the recent meeting of the Society of Automotive Engineers, J. D. Mooney, president of the General Motors Export Co., and Clarence M. Foss, an engineer on his staff, presented a paper in which, among other things, the subject of the building of light cars in America was brought up. It has always been believed that the type of light car which is produced in considerable numbers abroad would have practically no market in this country; and without a domestic market, it would not be possible to obtain sufficiently large production to reduce the selling cost to a point where it would meet foreign competition in foreign markets on a favorable basis.

It is possible, however, that in the future some American manufacturer may be able to design a light car that would sell at a very low figure, the horsepower of which would be small enough to fit in with the tax requirements abroad, but which would still have the power, riding qualities, appearance, and durability to make it attractive to domestic buyers. Should this happen, a new field would be opened up in the American automobile industry which would add considerably to the export markets of that industry.

How to Etch Steel Successfully

Numerous requests have come to MACHINERY for information about satisfactory methods for etching steel parts by the use of acids. While this process has long been employed in the machine industries, its application has not always proved satisfactory due to inadequate knowledge concerning the essential details. Every step in the work must be carried out carefully in accordance with certain requirements. The leading article in April MACHINERY "Etching Trademarks on High-speed Steel Cutters" will describe the methods employed by a well-known manufacturer of milling cutters and other metal-cutting tools in etching trademarks, size numbers, and other inscriptions on high-speed steel cutters.

THE INDUSTRIAL TRUCK ASSOCIATION

The formation of the Industrial Truck Association, composed of manufacturers of electric industrial trucks, tractors, storage batteries, and accessory equipment, has been announced. The new association headquarters are located at 52 Vanderbilt Ave., New York City, with C. B. Crockett as secretary. The initial membership consists of fourteen companies producing over 90 per cent of the products in this industry. The purpose of the association is to broaden present markets and to educate the industry as to the use of trucks and tractors in the solution of material-handling problems.

It is also expected that there will be further simplification and standardization of the product and the free exchange of statistical information. The president of the new organization is M. S. Towson, president of the Elwell-Parker Electric Co., Cleveland, Ohio; the vice-presidents are E. J. Bartlett, president of the Baker-Raulang Co., Cleveland, Ohio, and W. C. Allen, president of the Yale & Towne Mfg. Co., Stamford, Conn.; the treasurer is G. A. Freeman, president of the Automatic Transportation Co., Inc., Buffalo, N. Y. A list of the member companies of the association may be obtained from the association secretary.

* * *

SCREW MACHINE PRODUCTS ASSOCIATION MEETING

At the annual meeting of the Screw Machine Products Association, held in Chicago in January, the following officers were elected: President, Fred H. Fischer of the Fischer Special Mfg. Co., Cincinnati, Ohio; vice-president, Scott Osgood of the Curtis Screw Co., Buffalo, N. Y.; secretary, John S. Cochran of the Mac-It Parts Co., Lancaster, Pa.; treasurer, J. W. McDonough of the Sherman-Klove Co., Chicago, Ill. At the meeting, Dr. Swanson of the Swanson Ogilvie Co. presented his report on a survey of cost-finding methods in the screw machine products industry. This report outlined the methods employed in sixteen plants that were visited, supplementing this information by data gathered from sixty-eight questionnaires from additional plants. In the report, production methods, cost systems, estimating, and trade policies were discussed. The office of the association is at 232 Delaware Ave., Buffalo, N. Y.

* * *

The drilling of deep holes for oil wells has become a highly specialized engineering undertaking and almost unbelievable feats are being performed in this field of engineering activity. The Shell Oil Co. of Southern California, for example, has just completed the drilling of an oil well in the Signal Hill field to a depth of 7800 feet. This is believed to break all existing records in the world.

Use of Lock-Washers in Mechanical Designs

Special Applications of the "Shakeproof" Lock-washer Principle in the Design of Mechanical Devices and Assemblies to Meet a Variety of Unusual Requirements

By CARL G. OLSON, Vice-president and Chief Engineer, Illinois Tool Works, Chicago, Ill.

ORDINARILY we think of a lock-washer simply as a means of preventing a nut or screw from loosening. There are, however, other uses for lock-washers in machine design. The present article describes various cases of this kind in which "Shakeproof" lock-washers have been used. The article also describes some rather unusual applications or adaptations of the "Shakeproof" lock-washer principle which have been successfully employed to facilitate assembling and to insure holding the assembled parts securely in place.

The positive locking action of the lock-washers shown at A and B, Fig. 1, is provided by the twisted teeth set at equal intervals around the internal or external edge of the washers. When a nut is tightened on one of these washers, the teeth bite into both nut and work, forming a positive lock which is shake- and spread-proof. Vibration or additional turning or twisting only causes the teeth to bite deeper into the metal, and form a more positive lock.

Locking teeth similar to those shown on the washers A and B are also employed for a variety of small sheet-metal parts that are secured in place by means of screws or bolts and nuts. Such applications eliminate the necessity of using separate lock-washers, save space and weight, and invariably cut the cost of assembling. Typical examples of parts of this kind, made by the Shakeproof Lock Washer Co., 2501 N. Keeler Ave., Chicago, Ill., maker of the "Shakeproof" washers, are shown at D, E, and F. At C is shown a lock-washer designed for locking countersunk-head screws. This type of washer is placed under the head of the screw and is the only lock-washer made for countersunk-head screws.

These washers are made in sizes suitable for both large and small work. As they are comparatively thin, bolts and screws of minimum length can be used. The various types of washers can be stored in bins without danger of tangling. Thus no time is lost at the assembly bench in disentangling the washers.

In Fig. 3 is shown a section of an automobile spring and the U-bolts that secure the spring in place. Lock-washers like the one shown in the enlarged view at W are used under the heads of the U-bolt nuts at A. This may seem like a common application, but as a matter of fact, it subjects the lock-washers to extremely severe usage, and a great deal of experimenting was done with other kinds of washers before the "Shakeproof" washer was tried out and found satisfactory for the purpose.

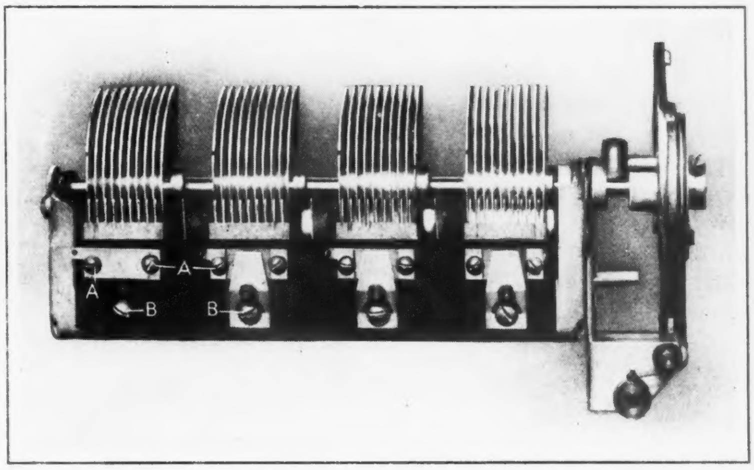


Fig. 2. Radio Condenser Assembly in which Lock-washers are Used

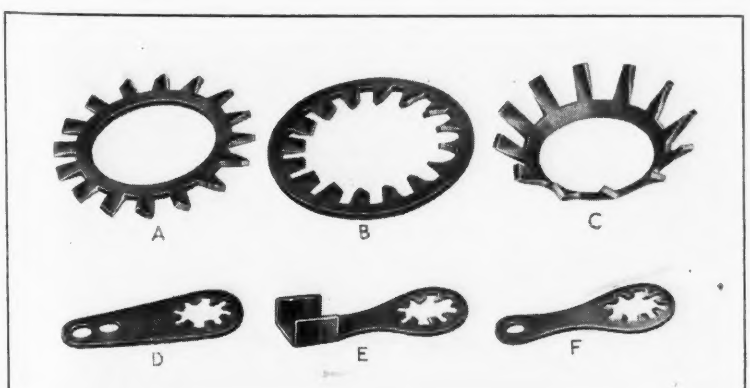


Fig. 1. Examples of "Shakeproof" Lock-washers and Terminal Lugs

Combination Lock-washer and Friction-driving Disk

A good example of the application of a special lock-washer is shown in Fig. 4. The special washer A is placed under the cranking lug B, which is screwed on the end of the crankshaft C of an engine. The washer serves the double purpose of positively locking the cranking lug in position and exerting spring pressure against the fiber ring D which presses the fan-driving pulley E against the friction flange F. The corners of the twisted teeth of the lock-washer bite into the metal of the starting

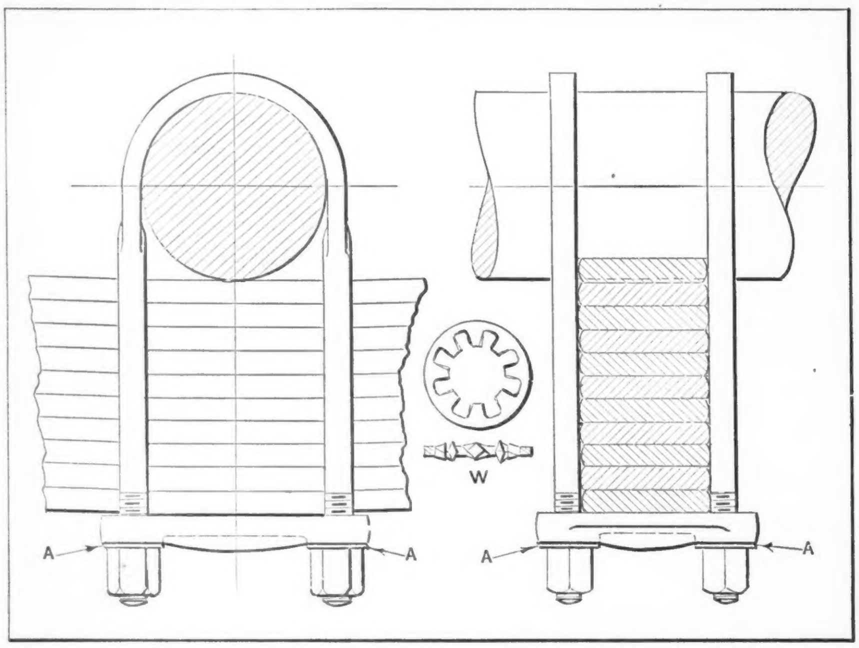


Fig. 3. Application of Lock-washers to Automobile Spring U-bolts

lug and the fan pulley seat or hub which is keyed to the end of the crankshaft, thus making a very satisfactory lock-washer and friction fan-driving arrangement.

"Shakeproof" Electric Wire Terminal

At *A*, Fig. 5, is shown a terminal end for electric wiring. The usual method of securing the terminals of wire to electric switches, etc., is by bending the bare end of the wire around the screw or post, as shown in the reduced-scale view at *D*, using a washer and nut to clamp the bent end of the wire in place.

At *C* is shown a "Shakeproof" terminal *A*, located on a post with the "wings" down ready to receive the clamping nut, which completes the connection, as shown at *B*. With this construction, the usual washer is eliminated and an exceptionally good electrical contact between the parts is obtained, as the teeth are slightly twisted so that their sharp corners press into the terminal and the nut. The material used for these connectors or terminals is cold-rolled steel hardened, tempered, and cadmium-plated. Cadmium plating is suitable for electrical work in places where acid-resisting qualities are essential.

Application of Lock-washers to Radio Equipment

In Fig. 2 is shown a late model radio condenser assembly on which lock-washers and soldering terminals are employed. All screws, such as shown at *A* and *B*, are locked in place by steel or phosphor-bronze lock-washers, which hold the insulating parts in place. A soldering terminal of hard-rolled phosphor-bronze, of the type shown at *F*, Fig. 1, is secured to the brass end plate of the condenser assembly for one of the important electrical connections. The locking teeth on this terminal make it unnecessary to employ a separate lock-washer.

Special Two-way Lock-washer

Rather an unusual method of holding a part in a fixed position on a stud is shown in Fig. 6. At *A* is shown a regular "Shakeproof" lock-washer which holds the nut *C* securely in place. At *B* is shown a special lock-washer of the same type which holds the hub *D* firmly in position on bracket

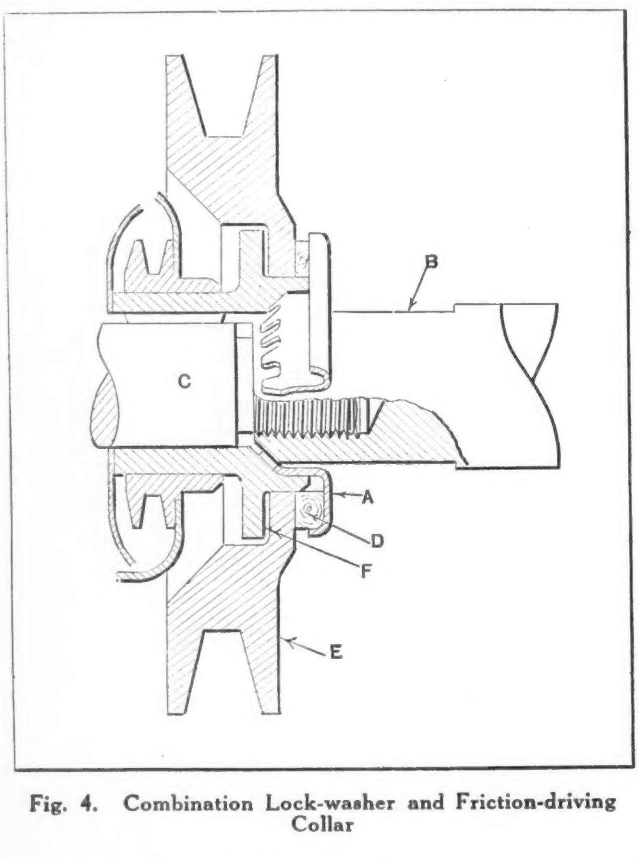


Fig. 4. Combination Lock-washer and Friction-driving Collar

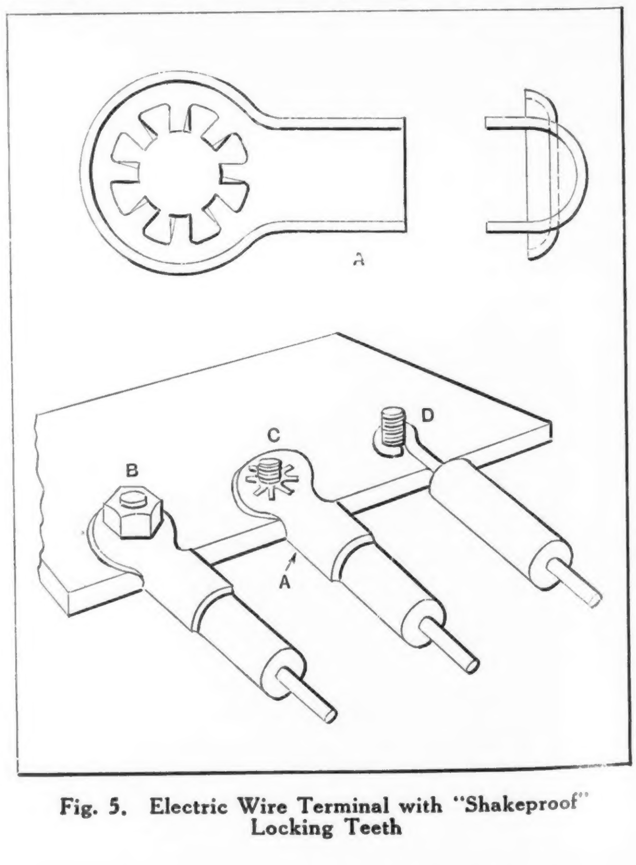


Fig. 5. Electric Wire Terminal with "Shakeproof" Locking Teeth

E, so that it resists turning movement in either direction. This feature is an important advantage in assembling parts that have a tendency to revolve at the time the clamping nut is tightened.

It will be noted that the teeth of the regular washer shown at *A* grip the parts in such a manner that they prevent rotation in only one direction. In the case of the lock-washer shown at *B*, some of the teeth are twisted in one direction and some in the other; this construction causes a locking action to be set up in both directions.

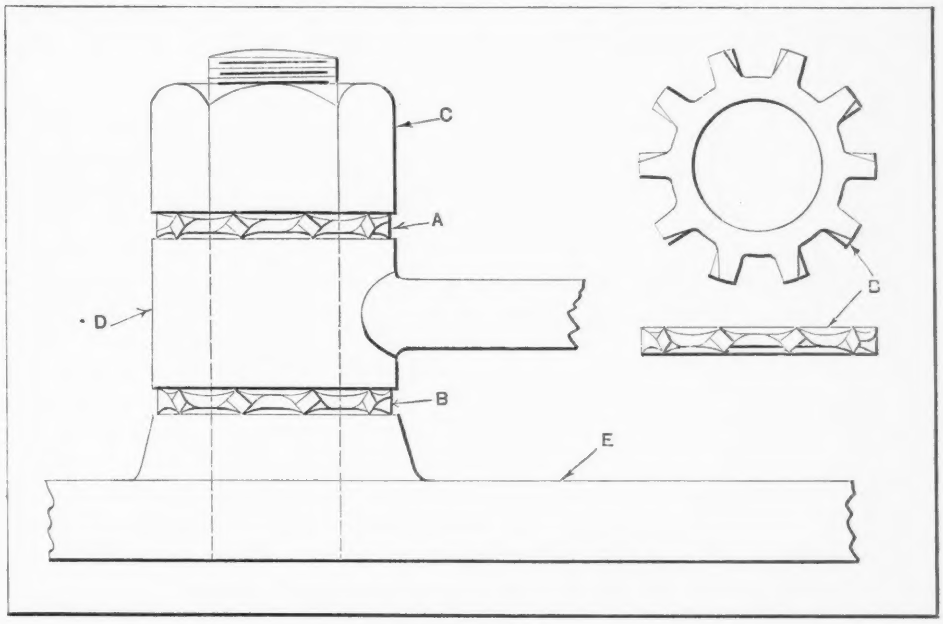


Fig. 6. Application of Special Two-way Lock-washers

* * *

QUICK DOUBLE-ACTING SPRING CLAMP WITH CAM-HANDLE LOCK

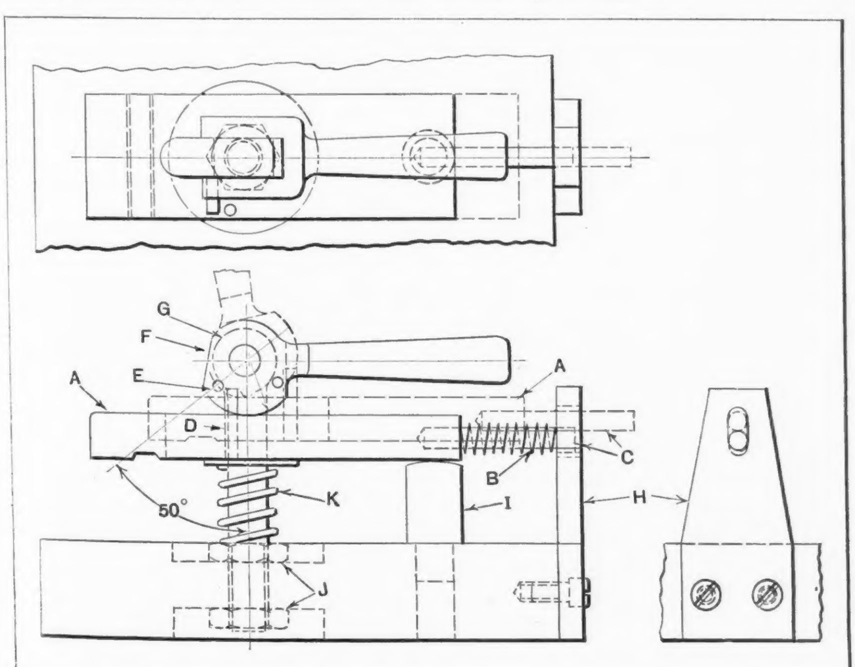
By E. F. EBERHARD

The accompanying illustration shows a simple yet quick and efficient double-acting clamp suitable for a variety of applications. Owing to its double-action feature, much less time is required for setting than with ordinary types of clamps. As there are so many different types of work on which this style of clamp may be used, the design and function only will be described.

The cam-lever handle *F* is a swing fit on stud *G*. Pin *E*, which is a drive fit in handle *F*, engages the pin *D* located in clamp *A*. Compression spring *B* is located on pin *C* at the rear of clamp *A*. This pin passes through an elongated slot in block *H*, which answers the double purpose of keeping clamp *A* in the proper position and acting as a stop for compression spring *B* when the clamp is being operated. Stud *I*, located in the bed of the fixture at the rear of clamp *A*, gives the proper leverage to clamp *A* when in the closed position. Stud *G* is located in the fixture base and passes through an elongated slot in clamp *A*; it has two lock-nuts *J* which are used to give handle *F* the proper adjustment. Spring *K* provides suitable pressure to keep clamp *A* against handle *F*.

In operation, the work is located in position in the fixture, with the handle in the open position shown by the dotted lines. The handle is then swung to the right. Pins *E* and *D*, held in contact by the pressure exerted by pressure spring *B*, force the clamp *A* forward and over the work, which is securely fastened by the cam action of the handle. To remove the work, handle *F* is swung to the left, releasing the cam pressure, and pin *E*, working against pin *D*, slides clamp *A* away from the work.

* * *



Double-acting Spring Clamp, Operated by a Cam Handle

Two interesting developments have recently been made in airplane construction. The Merrill plane, developed by Professor A. A. Merrill of the California Institute of Technology, is virtually automatic in control when leaving the ground and when alighting, and thereby minimizes the risk of disaster and lessens the demand made upon the skill of the pilot. The operation of the Merrill biplane can be quickly mastered by a beginner. Another development, known as the autogyro, has been made by a Spanish inventor, De La Cierva. This device makes it possible to effect a landing with only a limited run after contact with the ground. This is achieved by a wind-driven horizontal propeller which exerts a braking action and at the same time develops a sustaining force.

Special Tools and Devices for Railway Shops

Equipment Employed in Locomotive Repair Shops, Selected by Railway Shop Superintendents and Foremen as Good Examples of Labor-saving Devices

FIXTURE FOR LOCOMOTIVE HUB LINERS

By G. N. CAGLE, Central of Georgia Railway Shops

One of the many labor- and time-saving fixtures used in the Central of Georgia Railway Shops, Macon, Ga., is shown at *A*, Fig. 1. This fixture is

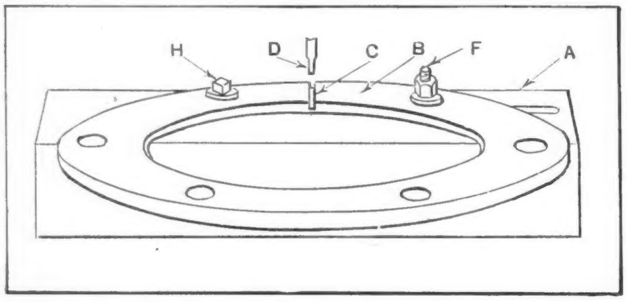


Fig. 1. Method of Holding Hub Liners when Splitting One Side

used on a shaper or planer when splitting hub liners for locomotive driving wheels or truck wheels which cannot be applied solid. The fixture is made from an obsolete driving-box shoe. The hub liners, one of which is shown at *B*, resemble very large washers, and have six equally spaced holes drilled through the rim. The liner is clamped to the fixture, which, in turn, is clamped in the shaper vise or strapped down to the planer table while one side of the liner is being split at *C* with a parting tool *D*.

The driving-box shoe is adapted for this work by milling a slot *E*, Fig. 2, to the size and shape indicated by the cross-section *X–X*. A collar stud *F*, Fig. 1, is made up to fit in this slot. One end of the stud is passed through the slot, after which a nut is screwed on, leaving just sufficient clearance to permit the stud to slide easily. A 3/16-inch hole is then drilled through the stud and nut, and a pin inserted to hold the nut in place. The upper end of the stud is threaded, and is made long enough to permit a washer and nut to be used for clamping the work in place, as shown in Fig. 1.

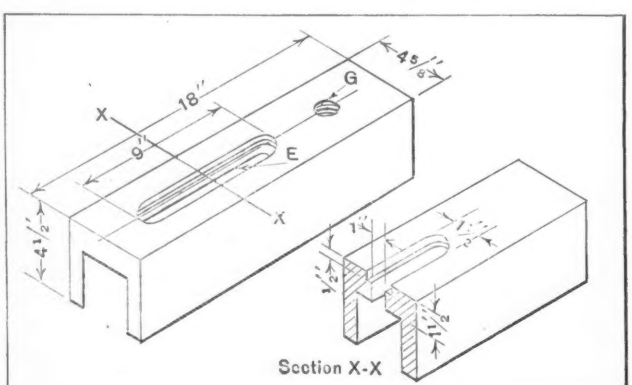


Fig. 2. Driving-box Shoe Adapted for Use as a Work-holding Fixture

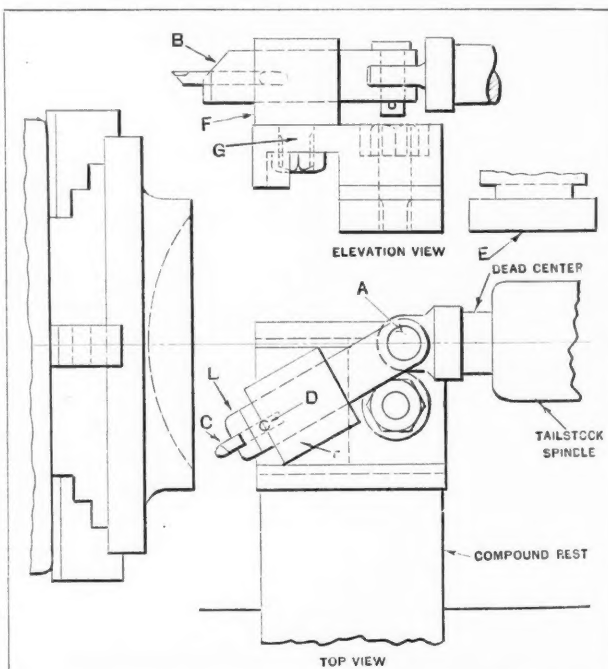
After the slot has been machined, a 7/8-inch hole *G*, Fig. 2, is drilled and tapped.

After a hub liner has been drilled to suit the wheel, the collar stud *F* is passed through one of the holes in the hub liner. The collar is then secured in place by a stud *H* and a nut and washer on the stud *F*. This combination of a slidable stud and a tapped hole permits collars with differently spaced holes to be readily accommodated.

TURNING CONCAVE BEARING SEATS

By E. A. LOTZ, Shop Foreman, Pennsylvania Railroad Co.

The radius-turning fixture shown in the accompanying illustration was applied to a lathe for use in turning the concave joints or seats of locomotive



Radius-turning Fixture Employed on Lathe

trailer truck friction bearings. It has also been used for machining the bearing seats of dry pipe joints. A pair of dividers is used for setting the cutting point or edge of the tool the required distance from the center mark in the head of the fulcrum pin *A*.

The cross-feed of the lathe is employed to swing the tool-holder about the fulcrum pin. The depth of the cut is controlled by turning the tailstock feed-screw in or out as required. In machining a number of duplicate joints or bearing seats, register marks can be placed on the tailstock spindle to enable the operator to reset the tool in the same position for the finishing cut on each part. With this method of setting the tailstock spindle, each joint or seat will be machined to the same depth

without requiring the operator to make any measurements.

The tool slot in the holder *B* is made of a sufficient depth to permit the tool to be adjusted in or out for a distance of one inch. Holders or bars of different lengths are also provided for larger as well as smaller work. The tool *C* is secured in place by a hollow-head screw *D*. The base *E* of the fixture is made to fit the slide or ways of the compound rest. The guide block *F* is a close sliding fit on the bar *B* and pivots or swivels on the stud *G* machined on its base.

LOCOMOTIVE PISTON-ROD EXTRACTORS

By H. H. HENSON, Foreman Machine and Erecting Shop, Southern Railway Co.

Closer and more thorough inspections are given locomotives today than ever before. Some railroads require piston-rods and valve stems to be extracted and hammer-tested for cracks or loose fits once every three months. The removal of the piston-rods from their cross-heads for these tests requires suitable tools or extractors. The ones shown in Figs. 2 and 3 have proved so efficient and satisfactory for this purpose that the writer can unhesitatingly recommend their use.

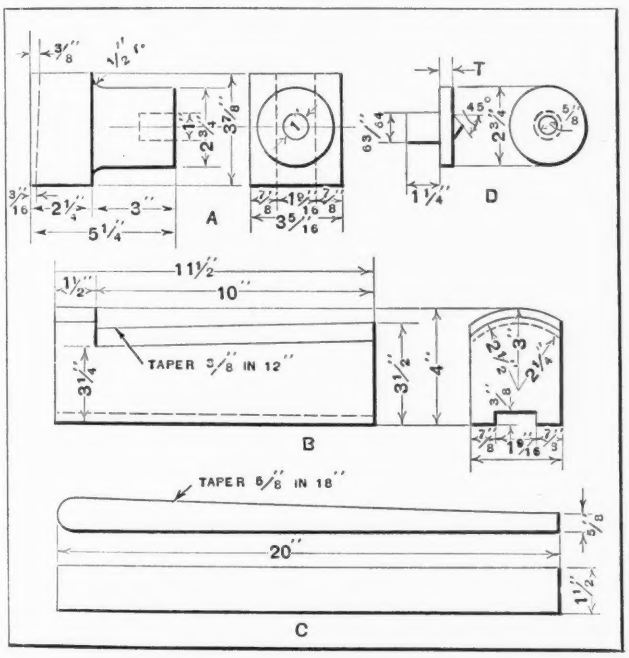


Fig. 1. Details of Piston-rod Extractor

The details of the extractor illustrated in Fig. 2 are shown in Fig. 1. This extractor consists of a plunger *A*, plunger thrust pin *B*, longitudinal wedge *C*, and plunger extension *D*. Four plunger extensions *D* of different lengths *T* are provided to suit various types of cross-heads. The lengths *T* of these extension plungers are 1/2, 3/4, 1, and 1 1/4 inches, respectively.

The extractor shown in Fig. 2 is very powerful, and will force out any size and kind of piston-rod when the wedge *C* is driven in, without requiring the cross-head to be heated with a blow-torch. It is adapted for extracting piston-rods that are secured in place either by a key or nuts.

The extractor shown in Fig. 3 is simple and powerful, but can only be used on cross-heads having a draw key slot. This type of extractor is very convenient, as it permits the piston-rod to be extracted without disconnecting the main-rod from the cross-head. It consists of the back thrust gib *C*, the tapered wedge *D*, and the front thrust gib *E*. These members are dimensioned to suit the type of cross-head from which the rod is to be extracted. The thickness of the parts is determined by the width of the keyway. The gibs and the wedge are given a taper of 5/8 inch in 18 inches.

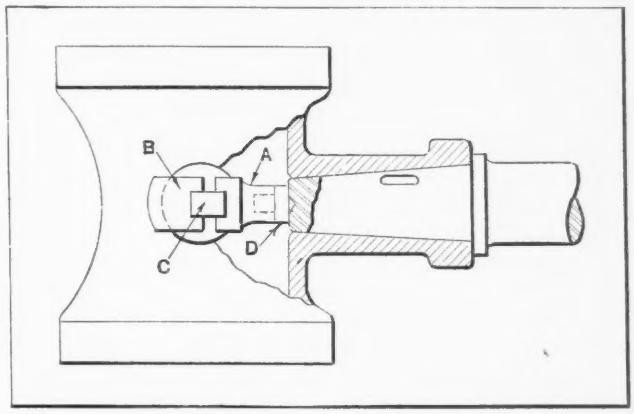


Fig. 2. Method of Using Extractor, the Details of which are Shown in Fig. 1

The illustration shows clearly how the back thrust gib *C* makes contact with the cross-head *G*, while the front gib is forced against the end of the slot in the piston-rod *F*.

The writer has found that old locomotive driving wheel tires provide the best material for making extractors of the kind described. This material can be tempered to just the right hardness. Carbon tool steel is satisfactory, but requires more care in hardening. If the parts are too hard, they will break, and if not hard enough, they will tend to rough up, and will not "kick" the rods out as they should.

* * *

The effect of machinery in the coal-mining industry is illustrated by the fact that in 1926 one miner in the United States produced 17 per cent more coal than in 1919. Incidentally, he also produced about four times as much as a coal miner in Europe. In 1919 about 60 per cent of the coal produced in the United States was cut by machine. In 1926, 72 per cent was so cut.

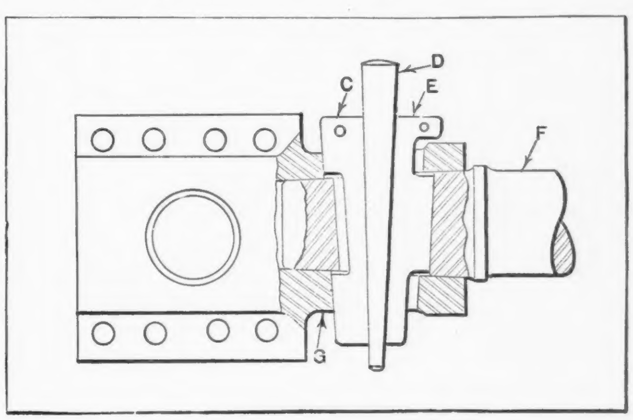


Fig. 3. Piston-rod Extractor for Cross-heads having Draw Key Slot

What MACHINERY'S Readers Think

Brief Contributions of General Interest in the Mechanical Field

HOW CANCELLATIONS CAN BE HANDLED

Provision should be made for cancellations in the purchase contract or order. Clauses should be included covering such points as the latest date upon which cancellations will be permitted, and payment for work already completed at the time of cancellation. The agreement should also state whether goods in the process of manufacture at the time of cancellation should be completed and delivered or whether work on such goods should be stopped at once and all claims settled. The amount of such claims for damage should also be specified in the contract or order. G. H. GUNN

GIVING THE LATEST MACHINES A TRIAL

Every progressive manufacturer should be on the watch for new labor-saving machines or attachments that can be used to advantage in his plant. A manufacturer who does this will gain the reputation of being the first in his field or industry to try out and install new and improved equipment. As a result, he will be likely to become the target for every salesman who has something new to offer, and he will have little trouble in keeping in touch with all progressive developments in his own particular field.

While the manufacturer's willingness to talk with any salesman who has anything to show, and to test out the device if it seems to offer something worth while, undoubtedly takes up a good deal of time, this practice is, in the writer's opinion, well worth while. In fact, the writer believes that the factory manager can do more to increase profits by devoting a considerable part of his time to this field than he can in any other way.

FREDERICK KAMPMEIR

FIRST IMPRESSIONS IN HIRING MEN

The manner in which a worker applies himself to a new position is largely determined by the impression he gets in his first contact. One of the outstanding qualities of human nature is the desire for a "square deal." From the moment the applicant enters a shop to apply for work, his eyes are open to minor details that the employer would consider too trivial to notice. The air of consideration for prospective workers is regarded by the applicant as indicative of the future treatment he will receive if he is hired.

Sometimes the applicant is greeted in such a manner that he brings to his work a certain antagonistic attitude. Future contact with the employment department will be tinged with an unpleasant recollection of the manner of his first reception, and later adjustment may present unnecessary difficulties because of a certain subsconscious antagonism which the worker cannot overcome. First impressions are the most vivid and stay with people the longest. Often they exercise an influence in spite of better judgment, and the employe finds it difficult to forget the fact that he was not treated with consideration in his first contact with the company, and consequently refuses to believe that the company has his best interests in mind in any plans in which he is later included.

Therefore, the employment manager should be a considerate, courteous, dignified representative of the company's policy and ethics, and be sufficiently sympathetic so that the applicant feels he is interested in his welfare. R. D. GUNNIS

MAKING A MAN RESPONSIBLE FOR HIS WORK

Every toolmaker and diemaker in the employ of one company has his personal steel stamp with which he marks his tools after he has completed them. These stamps carry a small design of some kind, such as a crescent, a star, or a three-leaf clover.

It has been found that if each man is made to mark his tools in this way, he will take more interest in his work, because he knows that if the tools do not work right, everyone along the line, from operator to superintendent, can tell at a glance by looking at the "trademark," as the men call it, just who made the tools. This is a big incentive for the toolmaker to do his best and take more personal interest in his work.

SIDNEY TAIZ

TRAINING SUB-EXECUTIVES

Sub-executives hold a new and important place in industry today, as they are in direct contact with the individual workers. To them the workers look for guidance, and they interpret the policy of the company. Much can be done to train these men for their tasks, such training primarily aiming at developing the qualities of leadership.

The trained sub-executive will be able to find ways and means of winning the confidence of those working under him to an extent that would be impossible without training. Even where there is a well conducted personnel department, a large number of the workers continue to make contact with the firm through the sub-executive and the foreman; and these men, if they understand their jobs, occupy a high place in the esteem and confidence of the workers.

The right kind of foreman will have the confidence of his men to such an extent that they will confide in him concerning their home affairs, thus placing him in a position to exercise his authority with better understanding and justice. To handle such matters intelligently, however, he needs training and a broad knowledge of the company's policies.

Trained sub-executives are also better able to analyze their own jobs and to see whether they live up to the important trust placed in them. They are able to visualize their relation to the plant as a whole. They also develop more quickly, and are qualified for advancement to positions of greater authority sooner than an untrained man.

B. SLADEN

SHOP PAPERS AID SAFETY CAMPAIGNS

Shop papers, such as are published by many large manufacturing concerns, can be of great assistance to the safety engineer in promoting campaigns against accidents. One way in which the seriousness of accidents can be brought to the attention of employes is to publish a list of the accidents each month in the shop paper, giving the names of the victims, the kind of injury, and the number of hours lost as a result of the injury. The latter item is perhaps the most important of all. The total number of hours lost each month through accidents undoubtedly makes a strong impression on the employes and tends to prevent them from becoming careless during the succeeding month.

JOSEPH BELL

PERMANENT EMPLOYMENT BENEFITS ALL

Industrial executives face their most difficult problem when orders become scarce and it is necessary either to lay off men or build up a stock. Several firms have found it possible, by careful planning, to keep their plants going at an almost even rate throughout the year, even though there is a seasonal demand for their product. They have found that this method of operation is economical from a business point of view. Trained men make fewer mistakes than newly hired help. They are more interested in the company and its product when permanently employed, and production costs are lower because over-time work in rush periods is avoided. An important item of cost is that of breaking in new men every year. It is less costly to pay interest on a stock of parts produced ahead of demand.

From the employe's point of view, permanent employment is more important even than high wages. The high hourly rates in the building industry, as compared with many other fields, are mainly due to the insecurity of employment in that field. Steady employment and a permanent income develops a higher type of man than the insecurity and worry that accompany temporary employment.

Discontent among workers is due to this insecurity of employment to a greater degree than to any other factor. It also discourages a man and interferes with his working efficiency. A man who four years ago was counted as one of the best workers in a well-known shop, after being laid off six or seven times, became so discouraged that his pride in his workmanship seems to have vanished. Insecurity of employment also affects the health of the worker, because nothing is more dangerous to robust health than worry. Whatever can be done to employ men continuously is a great contribution toward the solution of the labor problem.

RUSSELL J. WALDO

SUGGESTIONS FOR WRITING BETTER REPORTS

Many competent engineers fail to make their work count as it should, because they slight the preparation of reports; or else they do not know how to present a report in the most easily comprehended form. Reports should always be typed, in double spacing, and on one side of the sheet only. Folded or clipped sheets are poor form and short-lived. Manilla covers, punched for 8 1/2 by 11 sheets, should be used; a report thus bound commands respect and invites preservation with other valuable papers.

The report writer should constantly consider the reader. The man who is paying for a report generally knows little about engineering. A banker is interested in costs and profits and permanence —a business man in the same things and sales possibilities. One engineer receiving a report from another may be interested in technical details rather than monetary findings. Consequently, the essential facts should be presented in such form that the reader can find the information he desires with the least exertion. To that end, the writer believes in placing a "Summary" sheet at the beginning of every report made to a non-technical reader. That summary should briefly rehearse the object of the work. Then should follow a short text of the findings, together with a few important figures and a graph. The busy man can get all that he wants to know from this sheet. This should be followed by a full report, clearly divided into sections for reference and for use by subordinates.

DONALD A. HAMPSON

ARE THERE TOO MANY CONVENTIONS?

The greatest advance in American industry in recent years from a business point of view has been the cooperation that has developed between manufacturers engaged in the same line of industry. Trade associations and professional societies have had a tremendous influence toward the development of improved business and engineering methods. But everything can be carried to extremes. Are there not altogether too many conventions and meetings that the busy man is expected to attend? Are not many days wasted at meetings from which the attending business executive or engineer carries back comparatively little? Meetings are needed. The "get together" of men in similar lines of business is desirable, but there must be a proper balance between the time spent at meetings and the time spent in carrying out the routine work of industry.

The most important thing in this connection is to make conventions and meetings serve such distinctly constructive purposes that every man will come away from them feeling that he can do his own work better in the future because of having attended the convention.

OBSERVER

Static Deflection of Helical Springs

A Series of Charts for Quickly Determining the Deflection and Fiber Stress in Compression and Extension Springs

By J. W. ROCKEFELLER, Jr., Consulting Engineer, New York

THE charts shown in Figs. 1, 2, and 3 are for use in determining the static deflection and also the fiber stress in helical compression and extension springs subjected to a given static load. They may be used for springs made of any material, provided the modulus of elasticity and the elastic limit of the material are known. In addition to being used for determining the deflection and fiber stress under static loads, they can be used in determining such kinetic properties of springs as the deflection under a moving weight and the period of vibration.

The diagrams in Fig. 4 and the following notations are given here in order to avoid any misunderstanding of the terms used in the article.

J. W. Rockefeller, Jr.

Spring Notation Used

D = mean diameter of coil ($OD - d$);

D_2 = mean diameter at large end of conical spring;

D_1 = mean diameter at small end of conical spring;

d = diameter of wire (or side of square in case of square wire);

f = deflection per inch of solid height of spring under a load of 100 pounds, taking the torsional modulus of elasticity G as 10,000,000;

F = static deflection of spring $= f \times \dfrac{SH \times \text{load}}{G \times 10}$;

G_1 = torsional modulus of elasticity in millions; steel, 11.5 (from 10.5 to 12.5); phosphor-bronze, 7 (from 6 to 8); brass, 7 (from 6 to 8); and monel metal, 9.25;

OD = outside diameter of spring;

S = fiber stress in spring $= s \times W \div 100$;

s = fiber stress in spring under a load of 100 pounds (see charts Figs. 1, 2, and 3);

SH = solid height of spring; and

W = static load, in pounds.

The charts are intended to meet the requirements of draftsmen, designers, engineers, and others who desire to eliminate most of the long drawn out calculations necessary when the ordinary spring formulas are used.

Four factors are represented on the charts:

1. The horizontal lines indicate the mean diameter D of the coil, in inches; that is, the outside diameter of the coil less the diameter d of the wire.
2. The vertical lines show the deflection f per solid inch of coil under a static load of 100 pounds, based on the material having a torsional elastic modulus of 10,000,000 pounds per square inch.
3. The heavy oblique lines represent the fiber stress, in pounds per square inch, in the material under a load of 100 pounds.
4. The light oblique lines represent the size of the wire d from which the spring is coiled.

Application of Charts

In Fig. 1 the light oblique lines correspond to the Washburn & Moen gage sizes for circular-section wire. In Fig. 2 they correspond to fractions of an inch in square wire, and in Fig. 3 to Brown & Sharpe gage sizes for circular-section wire. The Washburn & Moen gage is used in the production or drawing of steel wire, and for this reason will be found useful in dealing with steel springs made of round stock. When springs are made of square stock, the chart Fig. 2 should be used, regardless of the kind of material. For material other than steel, Fig. 3 is applicable, as non-ferrous alloy wire is made to correspond with the Brown & Sharpe gage.

The use of the charts may be best illustrated by working out a numerical example. Suppose that the problem is to determine the deflection and fiber stress in an extension spring when a load of 30 pounds is imposed upon it. The solid height of the spring is 5 inches, the mean diameter of the coil 1 inch, and the wire No. 10 Washburn & Moen gage, which is 0.135 inch in diameter. The spring is to be made of steel having a torsional modulus of 11,500,000 pounds per square inch.

Locating on the chart Fig. 1, the intersection of the lines for the values $D = 1$ inch and $d =$ No. 10, it will be noted that the stretch per inch of solid height f is 1.80 inches under a load of 100 pounds. The value obtained from the chart is the deflection per inch of solid height under a load of 100 pounds, assuming that the modulus of elasticity is 10,000,000. In order to obtain the actual deflection under any given load for any solid height, it is necessary to multiply the figure obtained from the chart by the solid height of the spring, in inches; then divide the result by 100 and multiply by the actual load imposed upon the spring. The proper cancellations in the resulting fraction will give us the following fraction by which the result obtained on the chart must be multiplied:

$$\frac{\text{Solid height} \times \text{load}}{\text{Modulus in torsion in millions} \times 10}$$

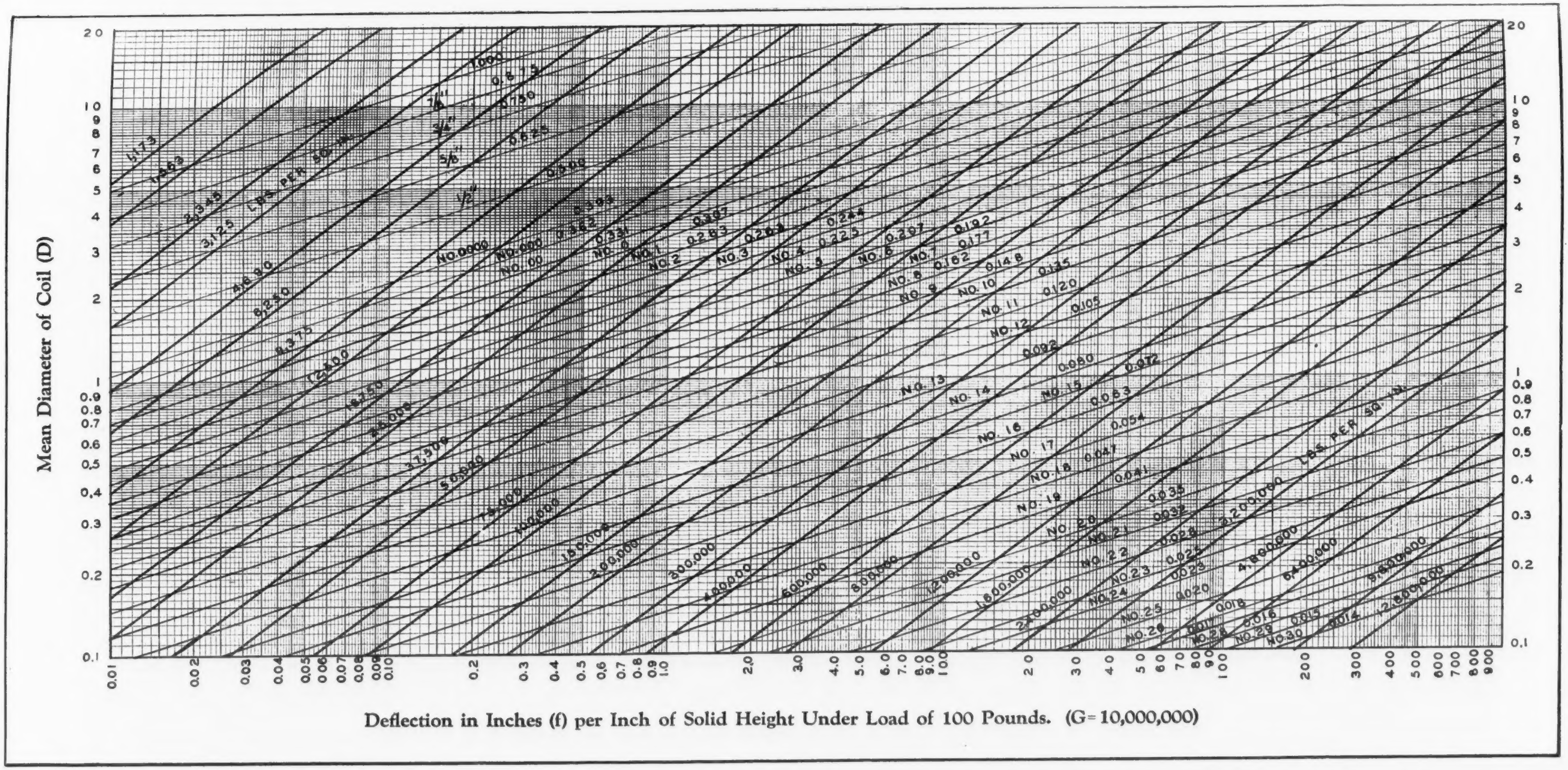


Fig. 1. Chart for Use in Designing Helical Springs of Circular Section Wire in Washburn and Moen Gages from No. 0000 to No. 30 as Indicated by the Diagonal Lines

Since the spring has a solid height of 5 inches and only 30 pounds is to be imposed upon it, the total deflection of the spring equals,

$$\frac{1.80 \times 5 \times 30}{11.5 \times 10} = 2.34 \text{ inches}$$

The fiber stress obtained from the chart is the fiber stress in the material under a load of 100 pounds, and in obtaining the actual stress in the material it is simply necessary to multiply the fiber stress obtained from the chart by the actual load imposed upon the spring and divide by 100, or multiply by the weight in pounds divided by 100. The fiber stress in the spring calculated above for a 30-pound weight would be $100{,}000 \times (30 \div 100) = 30{,}000$ pounds per square inch. The three charts, Figs. 1, 2, and 3, can be used in this manner to determine the deflection of a spring coiled from any material in the form of round or square stock having any modulus of elasticity, and can also be used to determine the fiber stress in the coils.

Application to Conical or Barrel Shaped Springs

In all the preceding calculations, we have considered only helical springs with coils having a constant mean diameter. The charts can, however, be used for the calculation of conical or barrel shaped

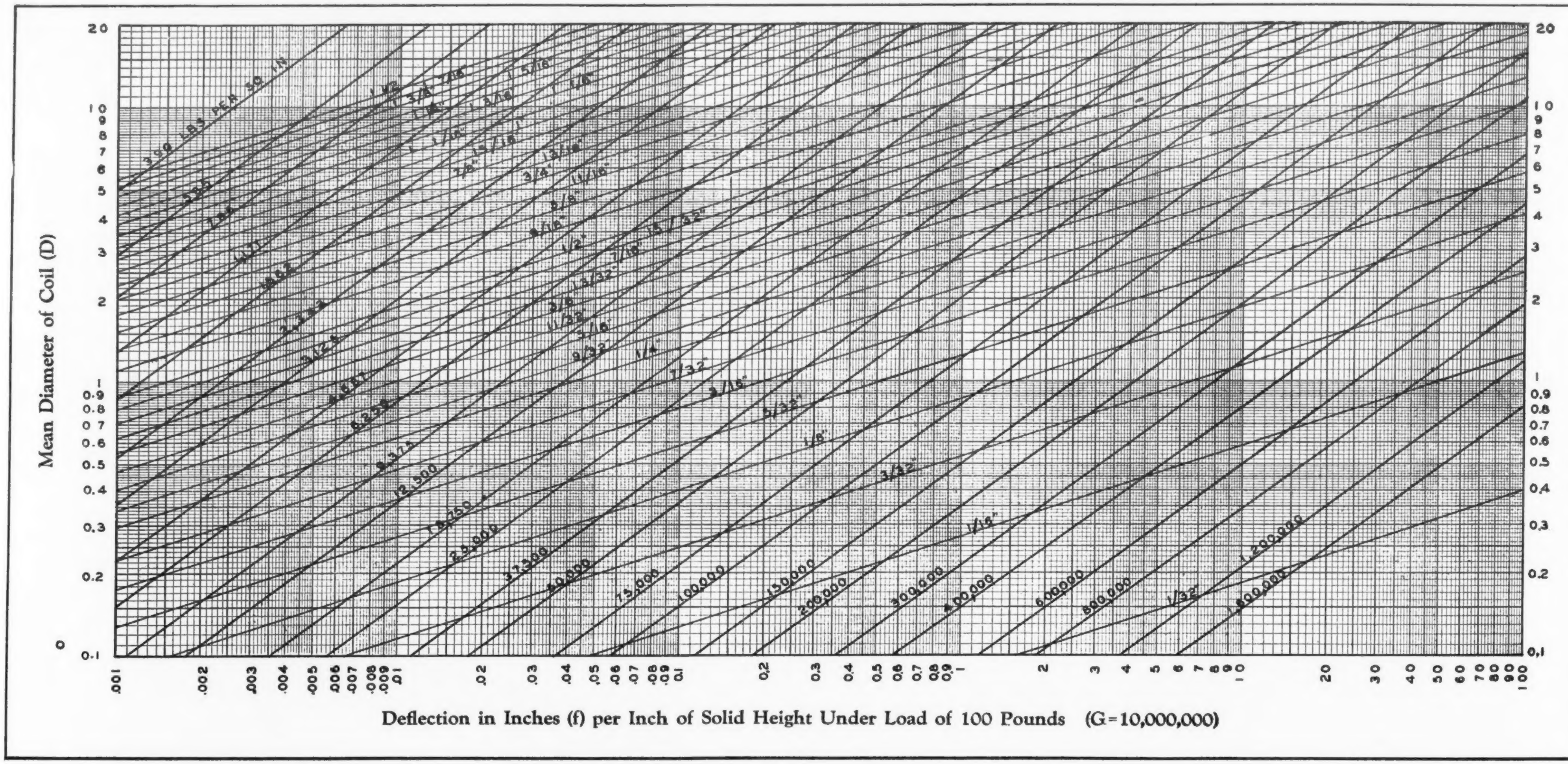


Fig. 2. Chart for Use in Designing Helical Springs Made of Square Stock of Any Material

springs by substituting for D in the chart the value given by the formula

$$D = \sqrt[3]{\frac{(D^2_2 + D^2_1) \quad (D_2 + D_1)}{4}}$$

in which D_2 is the largest mean diameter of the coil, and D_1 the smallest. This is assuming that all coils are active under the load and that the load deflection diagram of the spring shows as a straight line. This will be true of compression springs up to a point where the coils start to close, but in conical compression springs in which some of the coils close in advance of others, the formula will not hold true after the coils start to close.

Determining Fiber Stress in Open Ring

The charts can be used to obtain the fiber stress in an open ring by letting D equal the diameter of the open ring and d the diameter of the wire, and multiplying the fiber stress shown on the chart by 2. The actual fiber stress in the material will be slightly in excess of this, the amount of error increasing as the ratio of the diameter of the wire to the mean diameter of the spring increases.

It will be seen that an extension spring having ends formed by bending up the last half of the coil at one or both ends of the spring has a fiber stress

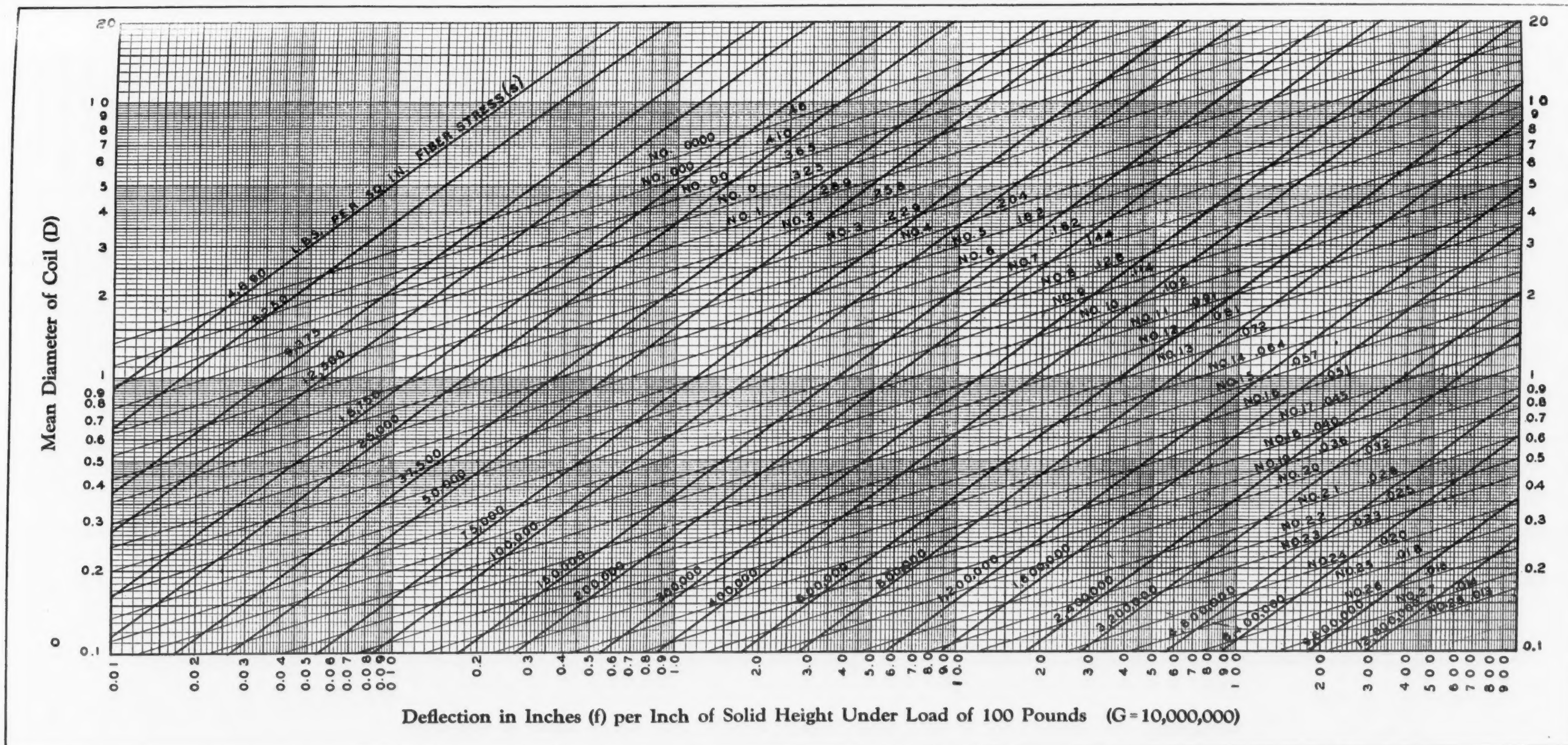


Fig. 3. Chart for Use in Designing Helical Springs of Circular-section Wire in Brown and Sharpe Gages, and for All Materials other than Steel

at this point equal to twice that in the body of the spring. The fiber stress at the base of the hook is a bending stress, and that in the body of the spring a torsional stress.

The safe stress in bending is somewhere in the neighborhood of 5/3 the safe stress in torsion, so that this excessive stress at the base of the hook is not such a serious matter as might appear at first glance. However, the base of the hook in a spring having ends formed in this manner is a very likely place for breakage. This occurs when the spring is over-stressed, and it will be seen, consequently, that the safe load is somewhat greater in the case of a compression spring than it would be in the case of an extension spring having the same proportions.

Method of Using Charts

The following examples and their solutions will serve to show the methods of using the charts:

Example 1—A spring is coiled from No. 10 Washburn & Moen gage wire. The outside diameter is 1.25 inches, and the solid height is 3 1/2 inches. Find the static deflection F of the spring under a load of 20 pounds, assuming the modulus of elasticity to be 11,500,000. Also find the maximum fiber stress S in the steel.

The mean diameter D of the spring equals the outside diameter minus the diameter d of the wire. Thus we have,

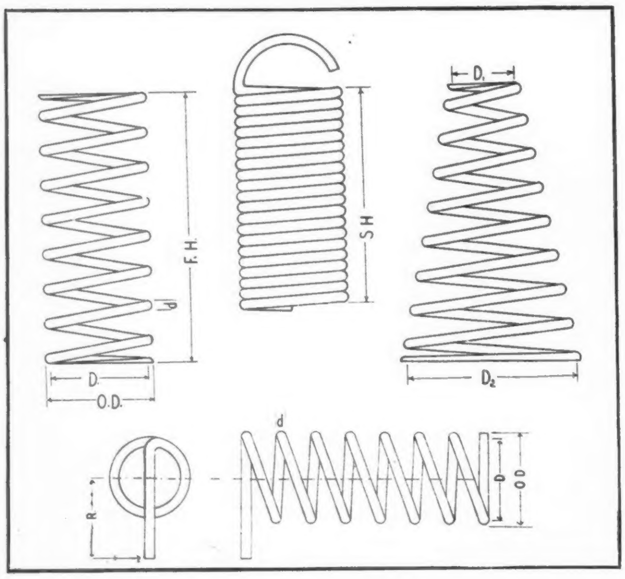


Fig. 4. Diagrams Indicating Notations Used in Helical Spring Design Formulas

$$D = 1.25 - 0.135 = 1.115 \text{ inches}$$

Referring to Fig. 1, we find that f equals approximately 2.5 inches when d equals 0.135 inch and D equals 1.115 inch.

Now for the total deflection we have,

$$F = \frac{2.5 \times 3.5 \times 20}{11.5 \times 10} = 1.52 \text{ inches}$$

According to Fig. 1, the fiber stress s, under a load of 100 pounds, equals 110,000, approximately, and for the maximum fiber stress S we have,

$$S = \frac{110{,}000 \times 20}{100} = 22{,}000 \text{ lbs. per square inch}$$

Example 2—Determine the maximum fiber stress in the material of a coil spring and the deflection of the spring under a load of 20 pounds. The spring is coiled from No. 8 Brown & Sharpe gage phosphor-bronze wire (0.128 inch in diameter), the outside diameter being 3/4 inch, the solid height, 2 1/2 inches, and the modulus of elasticity, 7,000,000. In this example we have:

$$D = OD - d = 0.75 - 0.128 = 0.622 \text{ inch}$$

Referring to the chart, Fig. 3, we find that f equals 0.55 when D equals 0.622 and d equals 0.128, and that the fiber stress s in the spring under a load of 100 pounds equals 70,000 pounds per square inch. Now, the total static deflection is:

$$F = \frac{0.55 \times 2.5 \times 20}{7 \times 10} = 0.393 \text{ inch}$$

Also, the maximum fiber stress is:

$$S = \frac{70{,}000 \times 20}{100} = 14{,}000 \text{ pounds per square inch}$$

Example 3—A compression spring having a solid height of 4 inches is to be compressed 2 inches under a load of 150 pounds. If 1/4-inch square steel wire is used, what is the outside diameter of the spring, taking the modulus of elasticity to be 12,000,000? What is the maximum fiber stress in the material? In this case, the static deflection of the spring equals 2 inches.

Then we have,

$$f = \frac{F \times G_1 \times 10}{SH \times W} = \frac{2 \times 12 \times 10}{4 \times 150} = 0.4$$

In this equation, G_1 equals the torsional modulus of elasticity in millions; f, the deflection per inch of solid height under a load of 100 pounds; and W, the static load in pounds. With $f = 0.4$ and $d = 0.25$, we find, according to the chart Fig. 2, that $D = 2.06$ inches, and that the fiber stress s equals 28,000 pounds per square inch, approximately. Now we have,

$$OD = D + d = 2.06 + 0.25 = 2.31 \text{ inches}$$

and

$$S = \frac{28{,}000 \times 150}{100} = 42{,}000 \text{ lbs. per square inch}$$

Example 4—A steel extension spring is to stretch 3 inches under a load of 300 pounds. Assuming that the modulus of elasticity of the material is 12,000,000 and the desirable working fiber stress is about 80,000 pounds per square inch, design at least three different springs that will comply with these requirements.

Let us take 3 inches as an arbitrary solid height for the spring. We now have,

$$S = 80{,}000 \text{ and } s = \frac{80{,}000 \times 100}{300} = 26{,}667$$

pounds per square inch. Also,

$$f = \frac{F \times G_1 \times 10}{SH \times W} = \frac{3 \times 12 \times 10}{3 \times 300} = 0.4 \text{ inch}$$

Referring to Fig. 1, it will be noted that when $f = 0.4$ and $s = 25{,}000$, we have $D = 1.85$ and $d =$ No. 2 wire. It may be seen that by making $SH = 2$ inches, f would be 0.6 inch, in which case d would be No. 1 wire and $D = 2.4$ inches. If SH were made 1 1/2 inches, f would become 0.8 inch and $d =$ No. 0 wire and $D = 3$ inches.

* * *

FOREIGN TRADE COUNCIL WILL MEET IN BALTIMORE

The Sixteenth National Foreign Trade Convention held by the National Foreign Trade Council will meet at the Lord Baltimore Hotel in Baltimore, Md., Wednesday, Thursday, and Friday, April 17, 18, and 19. James A. Farrell, president of the United States Steel Corporation, who is chairman of the National Foreign Trade Council, in announcing the convention, points out that last year 70 per cent of our export trade consisted of manufactured products, and also emphasizes that encouraging progress, both in exports and imports, has been made in our trade with Latin America in recent years.

Mr. Farrell will address the convention on "World Trade Today and Tomorrow." Other subjects to be discussed at the convention are "Economic Improvement in Europe"; "Canada—Our Best Customer"; "Advertising to Aid Foreign Distributors"; "Shipping and Foreign Trade"; "Investments in Latin America"; "Credit Insurance"—quoting German, British and American experience—; "Air Transport for Commerce"; and "Progress in the Far East."

INGENIOUS VARIABLE-STROKE OSCILLATING MECHANISM

An eccentric within an eccentric provides a means for conveniently changing the magnitude and speed of rotary or straight-line oscillations, in an ingenious mechanism devised by L. B. Green, consulting engineer of the Meadows Mfg. Co., Bloomington, Ill. While this mechanism was primarily developed for application to the "Select-A-Speed" washing machine built by the company mentioned, for imparting a rotary oscillating movement to the impeller in various amounts and at different speeds, many other applications are doubtless possible.

Fig. 1 shows this mechanism in the neutral setting with the center of eccentric block *A*, coinciding with the axis of the driving worm-wheel *B*. Block *A* fits the right-hand bore of connecting-rod *C*, and by swiveling the block in the connecting-rod bearing, the center of the connecting-rod bearing is offset from the axis of the worm-wheel to give the desired crank motion to the connecting-rod as the worm-wheel revolves. With the mechanism set as illustrated in Fig. 1, no motion is imparted to gear segment *D* and shaft *E*, but with the setting shown in Fig. 2, shaft *E* is oscillated an amount indicated by the shaded and dotted area at *X*.

Changes in the setting of eccentric block *A* are accomplished by shifting the splined shaft *F* vertically. The splines of this shaft engage corresponding splines in pinion *G*, and cause the pinion to rotate as the shaft is moved axially. When pinion *G* is rotated, it causes the eccentric block *A* to rotate, the pinion teeth meshing with internal teeth in the eccentric block. As the eccentric block revolves, the position of its center with respect to the axis of worm-wheel *B* is changed. The half-moon shaped block shown at *H* is integral with the worm-wheel.

Keys are employed in straight keyways of the splined shaft *F* and worm-wheel *B* to lock the unit together after each setting has been made, in conjunction with the locking effect of the teeth of pinion *G* meshing with those of eccentric block *A*. An important advantage of this mechanism is the fact that the amount of crank throw can be increased or decreased while the mechanism is in motion.

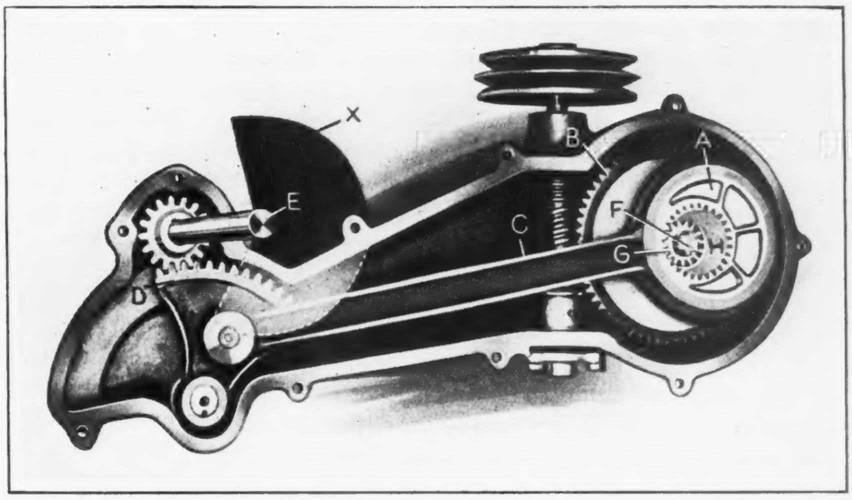


Fig. 2. Oscillating Mechanism Set to Give the Maximum Length of Stroke

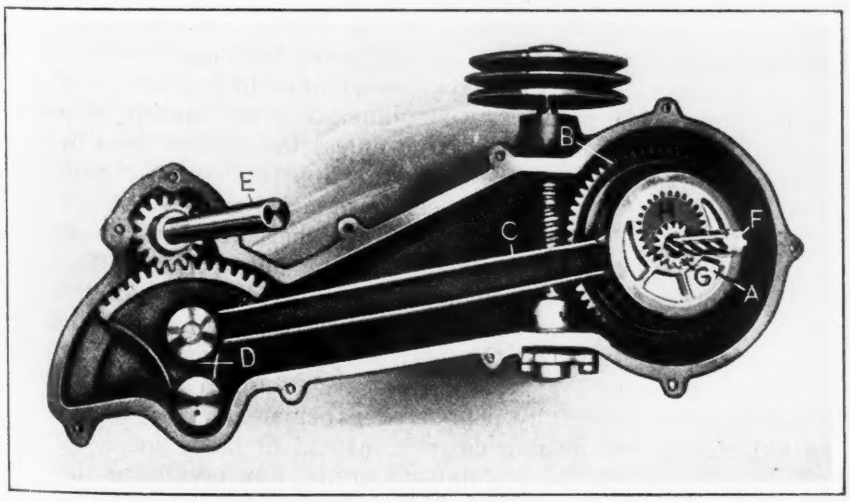


Fig. 1. Variable-stroke Oscillating Mechanism Based on a Compound Eccentric Principle

AIR TRANSPORT IN THE UNITED STATES

There are now more than forty air lines in the United States operating on a fixed schedule over airways of 13,000 miles. Twenty-three of these lines carry mail, and contracts are constantly being awarded for additional mail routes. More than 20,000 pounds of mail and express are being carried daily, and there are at least 125 manufacturers of aircraft, exclusive of companies producing only engines or accessories. The cost of the government operated air mail in 1927 was 97 cents per mile flown with mail. This cost, however, did not include such items as depreciation, insurance, cost of soliciting business, and taxes, which a private company would have to bear. The average passenger air rate in the United States in 1927 was 10.6 cents per mile. On lines where no mail business is being done the rate was 14 cents per mile. With the present traffic, it is doubtful if a company carrying passengers only can make adequate allowance for depreciation and show a profit at these rates.

* * *

The thing I learned in college that was of the greatest value to me in engineering was not so much the ability to calculate stresses, design gears, and experiment with the elemental problems of chemistry. These things many a man learns, and learning no more, becomes merely a draftsman in an engineering office. What I found of value in college was the study of the fundamentals of knowledge and those other things that gave me some kind of training in the exercise of common sense.—*George Gibbs*

Current Editorial Comment

In the Machine-building and Kindred Industries

DRAWINGS ARE NOT COMMON PROPERTY

As previously noted in MACHINERY, manufacturers of machinery and cutting tools frequently find that their customers consider blueprints submitted to them in connection with bids as common property. Ideas furnished by one manufacturer are used in placing the order with another.

An example of how far some buyers will go in this respect was recently brought to our attention: A large shop which required some special production machines asked for bids from four manufacturers. Each supplied a design, but none of the designs submitted met with unqualified approval. The engineers of the manufacturer who had asked for the bids concluded, however, that some features incorporated in each of the four designs submitted were of value; and they proceeded to design, in their own engineering department, a composite machine, containing original ideas from each of the four designs submitted. This machine was then ordered from a fifth manufacturer, who could take the order at a low price, as he had been put to no expense in connection with its design.

Although the law does not recognize property in ideas, except when patented, original machine designs are ethically the property of the manufacturer who has developed them, and should not be used for purposes detrimental to his business.

* * *

POLISHING COMES TO THE FRONT

An out-of-the-way corner of the shop, often dark and sometimes poorly ventilated, formerly filled nearly all the requirements necessary for the polishing department. The work of polishing was considered simple. It was done by comparatively unskilled labor, usually supervised by a foreman who had been a polishing hand himself. The department often ran itself, or at least without much attention from the management; and the work was done in about the same manner for twenty-five or thirty years, or more.

Until recently, there were fewer improvements in polishing machinery than in almost any other branch of shop equipment; but of late some shop managers have found that new processes developed by firms that have given their entire attention to polishing equipment and methods, not only improve the appearance of the polished product but considerably reduce the cost.

For years only a few engineers specialized in this field, but their number is increasing; and necessarily so, because expert advice is as much needed in this department as in any other in the shop. Managers of shops with polishing departments would do well to look over their polishing outfit carefully, as it is worth bringing up to date with the rest of their equipment.

MARK BAR STEEL PLAINLY

Is there any shop where bars of steel of different composition do not occasionally become mixed? In outward appearance there is little or no difference in bars of steel of different grades, and even experienced shop men often cannot tell them apart. For this reason, bars are kept in separate racks; but when one is removed and a part cut off, it may be returned to the wrong rack if there is no marking to identify it.

In many shops steel bars are now marked with lines painted on them immediately when they arrive from the steel mill, so that every bar may be easily identified. If a uniform method of marking were adopted and the bars marked at the mills before shipment, it would be a wonderful help to the users; but if this is not practicable, the next best help is for the shop that buys the steel to place an identifying mark on it when received. In one shop, streaks of paint of different colors are made along the whole length of the bar and cross streaks are used to indicate sub-divisions. Nickel steel, for example, is marked with a white streak the full length of the bar; and then blue, white, yellow, green, black or red cross streaks indicate the carbon content of the steel.

In some shops the bars are identified by merely painting the end of the bar with a certain color, but this has the disadvantage that if the bar is cut off and the end piece removed, the marking is lost and must be renewed.

* * *

MILLING CUTTER ENGINEERING

The development in milling machine design during the last fifteen years has made necessary an equally remarkable advance in the design of milling cutters. Machines of great capacity evidently are of little value unless the cutters used in them are capable of performing the work for which the machine has been designed.

At present, therefore, there are several manufacturers who make nothing but milling cutters, and engineers who specialize in milling cutter design. A few years ago any circular disk with cutting teeth on the periphery would pass for a milling cutter; now cutters are designed on the basis of carefully conducted experiments, and the making of milling cutters, instead of being merely a part of the toolmaker's trade, has become a field for engineering knowledge and methods. Many production problems have been solved by the application of engineering research methods to milling cutter manufacture, and users of cutters, when faced with a difficult milling job, would profit by consulting experienced cutter manufacturers as to the type best suited for their work, instead of simply ordering cutters of the regular type.

Fifty Years of Industrial Progress

A Pioneer in the Machine Tool Industry Looks Back on More Than Fifty Years of Mechanical Development

By JAMES HARTNESS, Past President of the American Society of Mechanical Engineers; President, Jones & Lamson Machine Co., Springfield, Vt.

HAVING been asked to review the changes that I have seen take place in the machine shop industry during a period of over fifty years, I believe that it would be of interest to many men in this field if I could present a picture of the shops as they were when I first went to work in Cleveland in 1878.

In the ordinary machine shop of that day, there were, generally speaking, only three types of machine tools—engine lathes, drilling machines, and planers. Some of the more highly developed machine shops in the East had a few other newfangled machines, which were barely known by name to the average machinist in the Middle West at that time. Milling machines, as well as shapers, were scarce, and automatic screw machines were looked upon with wonder. Those in use were employed mainly on small work in the East, and were of the single-spindle type. Turret lathes as we know them today were unknown at that time. There were machines provided with turrets, but they were generally of very simple design, limited in size, and employed on small work only. The grinding machine was unheard of, but emery wheels mounted in crude stands were used for grinding tools.

James Hartness, President, Jones & Lamson Machine Co.

The small tools used were mostly the product of the blacksmith and the grindstone. Even in reasonably well equipped machine shops of that day twist drills were not in general use. All drilling was done with forged two-lipped drills. All turning tools were forged by the blacksmith and ground by the machinist to suit his own fancy, everything turned being turned in an engine lathe. All measuring was done with outside and inside calipers and scales, the micrometer being unknown in the ordinary shop.

In these early shops, the blacksmith had very few mechanical devices to aid him in shaping his products. He was truly a master craftsman. He had to be able to forge to shape all tools required in the shop. Many machine parts that are now either machined to their right shape or drop-forged were at that time quite accurately forged to shape by the blacksmith on his anvil.

When I first went to work in Cleveland, the Lake Shore Railroad Shops were considered the best shops in the city. After I had worked at my trade for a couple of years, Worcester R. Warner and Ambrose Swasey came to Cleveland and founded the Warner & Swasey Co. in 1881. They carried with them from the East a number of new ideas as to how a machine shop should be operated. Many of the older machinists in Cleveland looked askance at a shop where the floor was swept every day and chip pans were provided under the machines, but

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Ever since 1878, James Hartness, well known throughout the mechanical industrial field as the designer and builder of the Hartness flat turret lathe, has been actively engaged in the machine industry. He received his early mechanical training in machine shops in Cleveland, after which he spent three years with a manufacturing plant in Winsted, Conn., and four years in Torrington, Conn. In 1889, he went with the Jones & Lamson Machine Co., Springfield, Vt., as machine designer, becoming successively superintendent, manager, and president. He has designed many different types of machine tools well known in the industry, and over one hundred patents have been granted to him. He is still actively engaged in developing mechanical devices, having just brought out the "Hartometer," a new type of thread gage. Mr. Hartness has also been much interested in astronomy. One of his inventions is the turret equatorial telescope, which has for its object the protection of the astronomer from the rigors of cold weather observation. He was President of the American Society of Mechanical Engineers in 1914, Governor of the State of Vermont in 1921-22 and President of the American Engineering Council in 1924.

to cap the climax we soon learned that they centered their lathe work with little drills instead of with a prick-punch, and they also required their men to work to a sixty-fourth of an inch. Of course, many dimensions in those early days had to be just as accurate as the dimensions in the shops today, when a good fit was required; however, these fits were not obtained by actual measurements, but by the slow process of filing and fitting.

It is difficult for the men who have come into the machine shop business in the past twenty or thirty years, or later, to imagine the conditions of conducting a shop with the limited facilities available in the late seventies. The telephone had just been invented and was not in general use. All communication with other shops had to be by messenger. The shops were lighted with oil lamps. When electric light first came into use, we were afraid that it would spoil our eyes, and I remember distinctly going down to the public square in Cleveland to buy colored glasses in order to protect my eyes against this dangerous new light.

As there were no grinding machines, everything that required a nice polish had to be filed and polished in the lathe by hand. The file and the chisel were two very important tools in those days. The average machinist of today hardly knows how to use either—at least not in the sense in which we used them.

Production Work on the Spline Miller

The possibilities in the application of special-purpose machines to general manufacturing operations are often overlooked. There are many instances, however, in which a machine bought for a special purpose has been advantageously applied to work at first considered outside its field. The article "Handling Production Work on a Spline Miller" in April MACHINERY will describe how a spline milling machine increased production on slotting operations, and made possible an improved one-piece construction of the product. The principles outlined are not applicable to spline milling alone. There are numerous parallel cases in industry where a similar broadening of the field of application of special machines is possible.

The Developments of the Last Fifty Years

Having mentioned the few machine tools that were in general use in the machine shops of those early days, it is hardly necessary to recount the developments in machine shop equipment that have been made in the last fifty years. In this period, the automatic screw machine has become common-place, and single- or multiple-spindle machines are no longer a novelty to any machinist. The grinding machine has brought about a complete revolution in the finishing of work to accurate dimensions; the turret lathe in its various forms has revolutionized the turning of work that was formerly done in engine lathes, and has been developed so that it is applicable to both small and large quantities. The milling machine has, to a large extent, replaced the planer, and is now built in sizes as large as any planer. Among small tools, the blacksmith's forged drill today is practically unknown, and the younger machinists have never seen any drills except twist drills.

In the general field of scientific and engineering knowledge, we have seen a greater development during the last fifty years than in all the centuries preceding. The telephone and electric light have already been referred to. Later came the safety bicycle, the manufacture of which created a boom in the machine tool industry in the nineties. Then came the automobile, which has stimulated a greater development in machine tool design and construction than any other one factor. In this same period, the world has been startled by the discovery of the X-ray, wireless telegraphy, the flying machine, the radio, and the televox, and now we are about to develop television.

The Promise of The Future

What of the future? In the machine shop field, we may expect to see new cutting metals developed that will require the redesigning of many present-day machine tools to make higher speeds and greater power available. Semi-automatic and automatic machines will reach even greater perfection than today, and constant efforts will be made to eliminate hand labor.

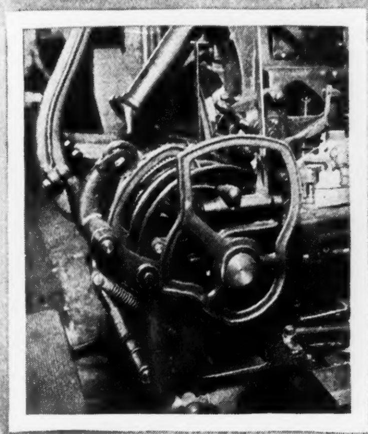
In the general engineering field, it is difficult to predict what may happen. When we look back over the last fifty years and see what has been done, it seems almost rash to say that anything is impossible. Great developments may be expected in aviation, radio, and television. The day will doubtless come when it will be found possible to rise vertically into the air and to descend vertically with such control of the speed of descent that easy contact can be made with the landing place. Such a development would make the flat roofs of the large buildings in our cities convenient parking places for airplanes. The television and the radio combined may make it possible in the not distant future to see and hear great events that take place anywhere in the world.

In looking forward to all these engineering achievements, we are hoping for a corresponding intellectual and spiritual development, so that these great advances may not prove a boomerang that will be used mainly for destruction, but rather for increasing the happiness and welfare of mankind.

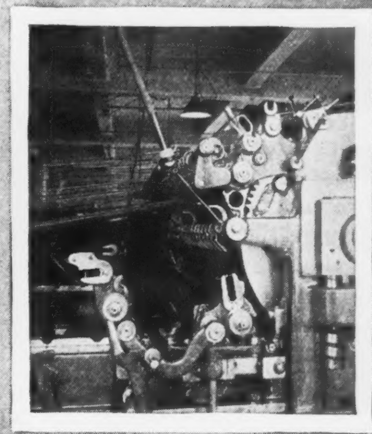
* * *

WIDE FIELD FOR CHROMIUM PLATING

The wide use of chromium plating is illustrated by the fact that one Chicago concern, alone, has plated more than 2000 different articles, ranging all the way from watch cases to propeller shafts for Diesel engines. Among the articles plated at this plant are dies for stamping and drawing metals, wire-drawing dies, mandrels for tube drawing, copper rolls from which wall paper is printed, torch-welding tips, cutlery, jewelry, golf clubs, and brick, bottle and rubber molds. A worn-out plug gage, built up by this process, is said to outlast five new ones. Chromium-plated files have been known to outlast three to seven ordinary files. It is a matter of record that as many as 9,000,000 impressions have been made from electrotypes plated with chromium.



Ingenious Mechanical Movements



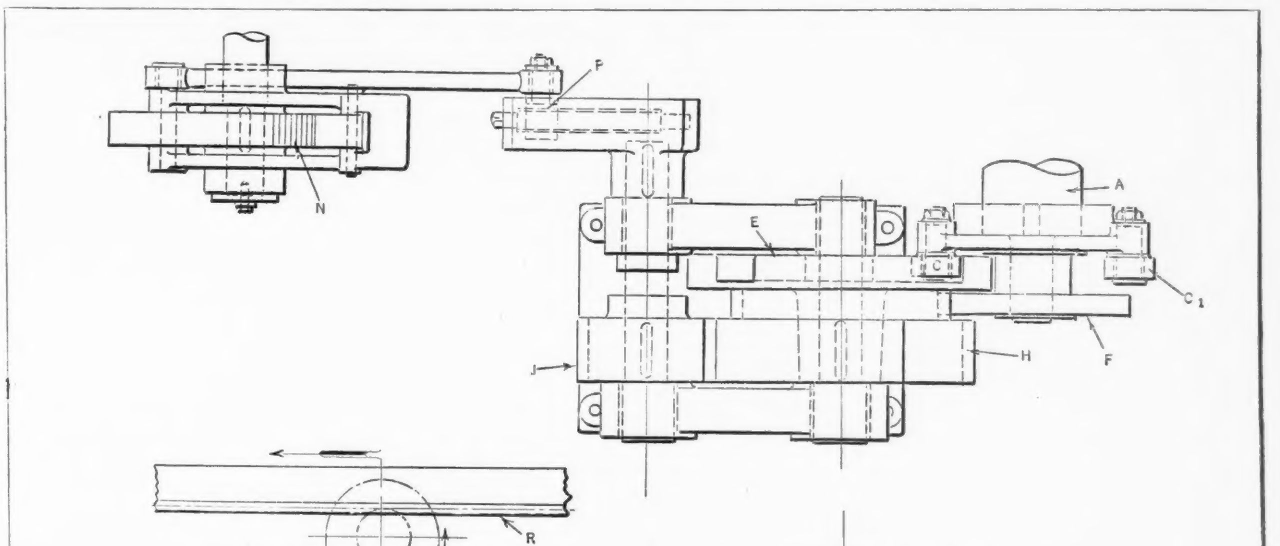
INTERMITTENT SPACING MECHANISM

By R. TILKIN

The feeding or spacing mechanism to be described is used on a large perforating press. This mechanism serves to advance the plate automatically after each series of holes has been punched. It is designed to advance the plate as quickly as possible, so that the idle stroke of the punch will be reduced to a minimum. With this mechanism, the advancing or feeding movement occurs while the crank that operates the press slide makes one-fourth revolution. To accomplish this result, a modification of the Geneva movement is utilized.

The feeding mechanism is driven from shaft A (see accompanying illustration) to which is attached plate B carrying rollers C and C_1. Roller C comes into engagement with groove D of the Geneva wheel when the main crank of the press is within 45 degrees of its upper position. After roller C has turned wheel E one-quarter of a revolution and as it is leaving groove D, roller C_1 comes into engagement with groove D_1, so that the turning movement of wheel E is continued for another quarter revolution. It will be seen that while plate B makes one-half revolution, wheel E also turns the same amount; then as plate B turns another half revolution, wheel E remains stationary.

Attached to shaft A beyond plate B (see plan view) there is a circular cam or segment F which engages an arc G of corresponding radius, thus locking wheel E while rollers C and C_1 are out of



Intermittent Spacing Mechanism of a Large Perforating Press

engagement. During the second revolution of plate *B*, roller *C* engages groove *K* and roller C_1, in turn, engages K_1. During the following half turn of plate *B*, cam *F* is in engagement with arc G_1, so that Geneva wheel *E* is again locked. This wheel is integral with a 40-tooth spur gear *H* which drives a 20-tooth pinion *J;* consequently, for every half revolution of wheel *E* pinion *J* makes one complete turn.

On the shaft carrying pinion *J* there is a crank having an adjustable crankpin. This crank imparts an oscillating movement through link *L* to the segment-shaped part *M* to which is attached a pawl engaging ratchet wheel *N*. The intermittent motion thus imparted to the ratchet wheel is transmitted through a train of gearing to rack *R*, which is attached to the plate feeding table. By varying the radial position of crank *P*, and consequently the movement of the feed pawl, the advancement of the work can be varied as desired.

Since a quarter turn of wheel *E* causes one-half turn of pinion *J*, it will be seen that the engagement of roller *C* with wheel *E* results in the forward or feeding stroke of the ratchet wheel, whereas engagement of roller C_1 returns the feeding pawl to its starting position. This mechanism operates smoothly, because wheel *E* is gradually accelerated during one-eighth revolution and then gradually decelerated during one-eighth revolution as each roller successively comes into engagement with it. This is an important feature, since the primary object of this mechanism is to provide the required feeding movement in a minimum length of time.

ANGULAR MOVEMENT FOR GAGING DEVICES

By H. A. SEABRIGHT

Most size-gaging devices depend for their operation upon linear motion which is magnified by levers or gears. The actuating point moves an amount equal to the difference in size between the piece being gaged and the minimum for which the actuating point is set. In the case of a size-gaging machine with successive gaging heads set to sort the pieces in a range of sizes with steps of 0.001 inch, the actuating point has a movement somewhere between 0 and 0.001 inch. Some means of magnifying this small movement is necessary for operating the sorting mechanism; moreover, the line of movement of the piece being gaged is at right angles to the line of movement of the actuating point, so that a sort of wedging action is utilized as the piece being gaged is forced between the stationary and movable contact points.

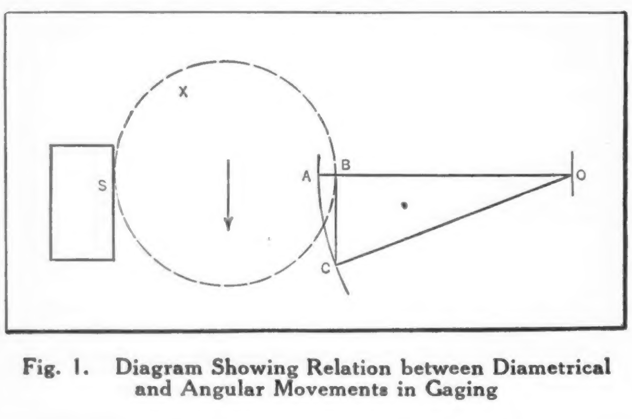


Fig. 1. Diagram Showing Relation between Diametrical and Angular Movements in Gaging

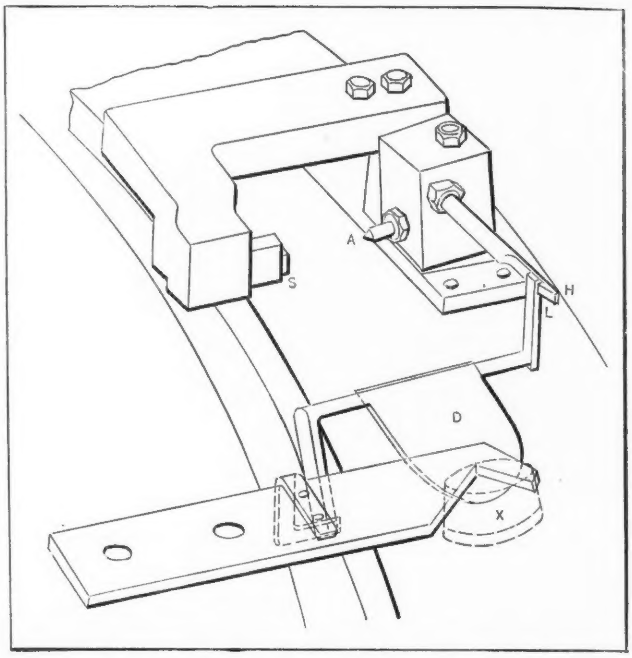


Fig. 2. Size-gaging Fixture Using Pivoted Contact Point

If the movable contact point is pivoted so that it can turn through a small angle, a much greater movement is obtained than when the movable contact point moves diametrically relative to the piece being gaged. The principle upon which this action is based is shown in the diagram Fig. 1, where *S* represents a stationary contact point, and *A* a movable contact point. It is readily seen that when an object *X* is passed between the two contact points, a diametrical movement of *AB* is obtained in one case and a circular movement of *AC* for the pivoted contact point with axis at *O*.

For example, if the object *X* has a diameter 0.001 inch greater than the distance between the points *A* and *S*, the diametrical movement *AB* will equal 0.001 inch. If the contact point *A* swings about the axis *O* and *OC* equals 1 1/2 inches, then *BC*, which is practically equal to *AC*, will be:

$$BC = \sqrt{OC^2 - OB^2}$$
$$= \sqrt{1.500^2 - 1.499^2} = 0.055 \text{ inch}$$

If the length of *OA* is increased, greater values of *BC* are obtained. For most purposes, a movement of 0.055 inch is sufficient to operate a gaging mechanism direct, or a suitable extension, greater in length than *OC*, can be used in connection with the pivoted contact point.

The gaging fixture shown in Fig. 2 represents a practical application of the angular displacement principle described. A stationary contact point is at *S* and a pivoted movable contact point at *A*. The pieces to be gaged are caused to pass between the contact points. If the pieces have a diameter greater than the distance between the points, a circular movement will be imparted to the movable point *A*, which movement will be transmitted to the attached hook *H;* this, in turn, disengages the latch *L*, allowing the door *D* to drop and discharge the piece *X* into a suitable receptacle. The door is then closed by means of a suitable finger and retained by means of the latch and hook. A series of such gaging fixtures can be arranged to sort the pieces, so as to remove over-sized and under-sized

pieces, as well as to select a range of sizes as may be required.

Gaging machines that are equipped with these fixtures have been used in gaging the cones of tapered roller bearings at the Columbus Plant of the Timken Roller Bearing Co. The cones are sorted into over-size and under-size lots, and also into a range of twelve sizes varying in diameter by 0.002 inch. A test showed that variations of only 0.001 inch were practicable. The movable contact point is tipped with a smooth-faced diamond. The stationary contact point is of a very hard alloy such as stellite.

Referring again to Fig. 1, it is readily seen that as the piece *X* is larger or smaller, the angular displacement of the pivoted contact point will vary accordingly and thus indicate the relative size of the piece. The size indicating device shown in Fig. 3 is an application of this feature. The contact point *A* is pivoted at *O*, with indicating pointer *P*, dial *D*, and stationary points *S*. As the piece *X* is reduced in size, the pointer gradually descends until the desired size is obtained. This indicator has but one moving part, and is adaptable to work of a high degree of accuracy.

This size indicating device is intended for continuous application to the work after the latter has been partly ground and is approaching the required size. The graduations indicate the maximum size, normal or correct size, and minimum size, and the movable contact point is adjusted or calibrated from standards. The adjustment is such as to prevent the pointer from falling below the minimum or zero position as long as the work is within the allowable limit.

A notable feature in connection with the pivoted contact point gaging device is that it receives a motion almost exactly in the same line as that of the piece being gaged. In devices where a diametrical movement is used, there is practically 90 degrees difference between the lines of motion, causing excessive friction and wear, which, in turn, results in inaccuracy and delays. Machines on which the pivoted mechanism has been used hold their setting exceptionally well, in some cases gaging 1,000,000 pieces without resetting or adjusting. Such parts as are subject to wear can be made practically indestructible, so that a high degree of accuracy can be maintained indefinitely.

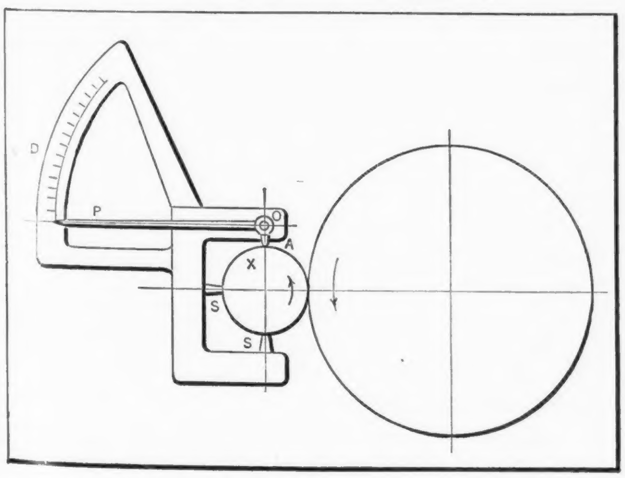
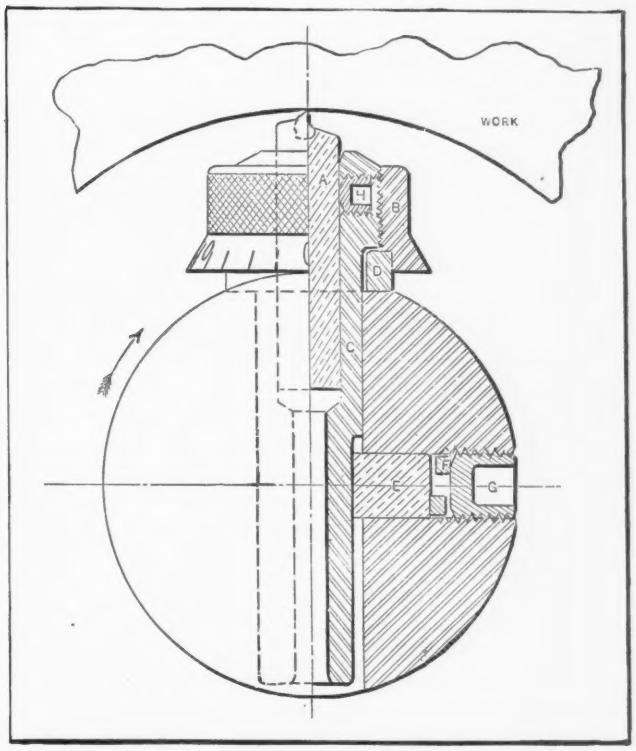


Fig. 3. Size Indicating Device Using Angular Displacement Principle



Precision Adjustment for Boring Tool

PRECISION ADJUSTMENT FOR BORING TOOL

By EARL FENNER

The micrometer type of adjustment for boring tools shown in the illustration may be employed to advantage when quick and accurate setting of a tool or diamond is required, thus doing away with the old practice of adjusting the tool either by means of a hammer or screw. The illustration shows a tool made for finish-boring the main bearings of aircraft engine crankcases. This work is done in a horizontal boring mill, the boring-bar extending through the crankcase into the back-rest.

The boring-bar has a 5/8-inch reamed hole in which shank *C* is a sliding fit. The bar is also counterbored 1 1/16 inches to provide a bearing for collar *D* and, the counterbore is made of such a depth that the graduated dial *B* will just clear the bar. A 7/16-inch headless set-screw *G*, a spring washer *F*, and a 3/8-inch brass plug *E* hold shank *C* tight enough to prevent it from loosening while boring, but not so tight as to prevent dial *B* from being turned by hand to make the necessary adjustments. Plug *E* bears against a flat milled on shank *C*. Thrust collar *D* is hardened and ground on both faces, and is a press fit in dial *B*. The counterbore in *B* for collar *D* should be machined when the threads in *B* are cut, so that the bearing face for *D* will be square with the threads. The diamond mounting *A* fits into a 3/8-inch hole in part *C*. Drill rod or high-speed steel may be used when a diamond is not necessary. Tool *A* is held in position by a 1/4-inch headless set-screw *H*. The thread in dial *B* and on part *C* is 7/8 inch in diameter, and there are forty threads per inch. As dial *B* has twenty-five graduations (with numbers at every fifth division), it is evident that each graduation represents an adjustment of 0.001 inch, although the large graduations make it easy to estimate finer adjustments.

Designing Arc-Welded Machine Bases

Suggested Methods of Design of Machine Bases Made from Arc-welded Structural Steel Shapes and Piping

By J. L. BROWN, Mechanical Engineer, Westinghouse Electric & Mfg. Co.

MACHINERY bases are of almost infinite variety and shape, because of the many different kinds and shapes of apparatus that must be mounted on them. The use of a cast construction for such bases has, in the past, seemed most satisfactory, as patterns can readily be made to even the most irregular shapes and the resulting casting will furnish a reasonably rigid unifying structure which adapts itself to the various mounting requirements of the pieces of apparatus to be held in a definite position. However, the cost of castings is high, especially when only one or two of a kind are required, and the pattern cost is a large item of expense; storage space for patterns is also expensive.

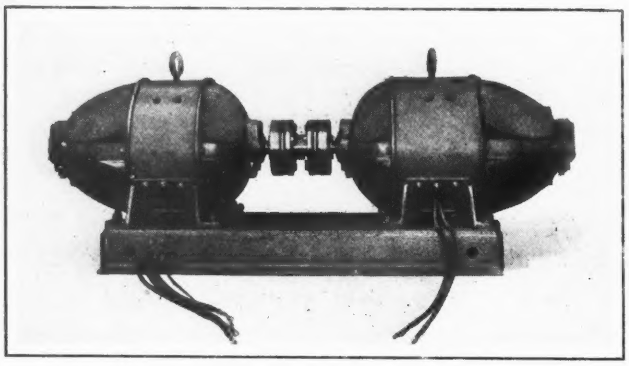


Fig. 1. A Welded Base Similar in Appearance to a Cast Base, but Unnecessarily Expensive

The earlier attempts to substitute rolled-steel shapes fabricated into structures of suitable form for machinery bases met with but limited success, due largely to the fact that riveting was then the only means of joining the various members. Riveting necessitates the use of a lapped joint between the members to be riveted, and prohibits altogether the use of some of the most efficient steel shapes now being used in the more recent machinery base structures. It is only within recent years that the use of the metallic arc has been employed to any considerable extent for joining rolled-steel shapes as a manufacturing process in producing machine structures, but its convenience in securing satisfactory right-angle and edge-to-edge joints between steel members is resulting in a great increase in its use. The many economies attendant upon the use of this method are readily realized in the construction of machinery bases or bedplates, if certain simple principles of design are carefully followed.

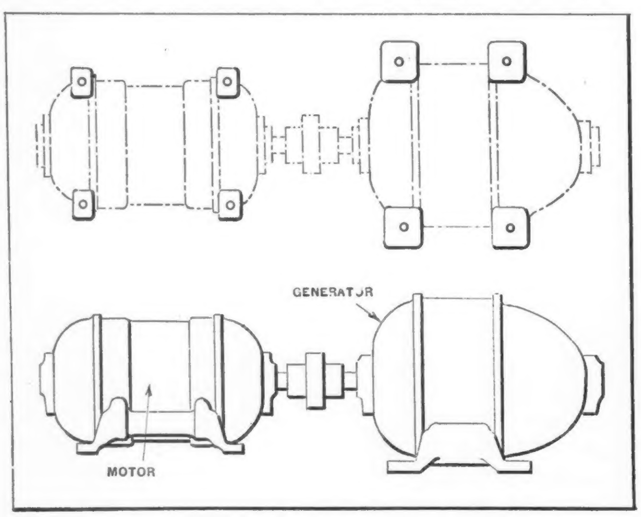


Fig. 2. Machines for which a Welded Base is to be Provided

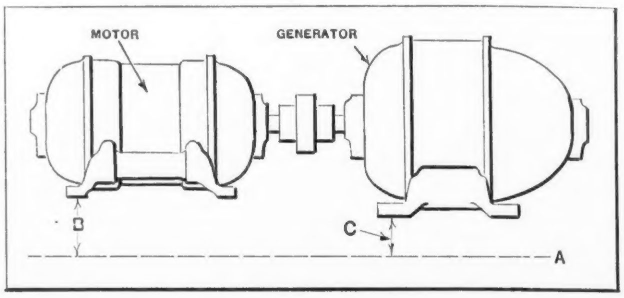


Fig. 3. Difference in Base Levels of the Machines to be Provided with Bases

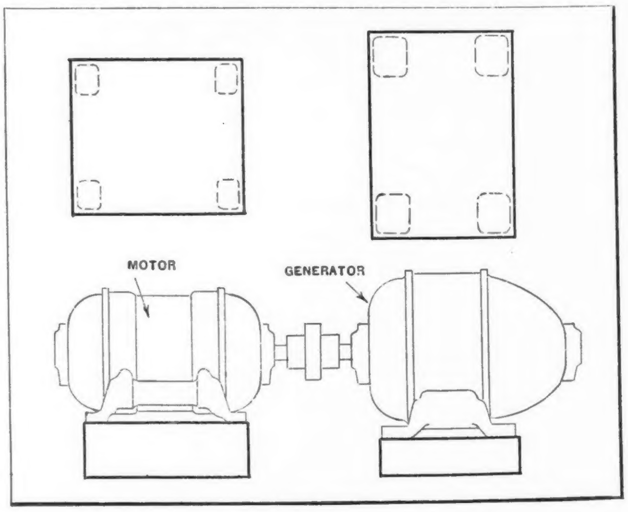


Fig. 4. Simple Box-type Base Design

In effecting the transition from a cast to a welded structural design, it is well to avoid trying to make an exact copy, in rolled steel, of the physical form of the cast construction. An attempt to obtain similarity in appearance will almost always result in a more expensive structure than is necessary, and at the same time, probably in a less rigid one, for a given weight of material, than could be produced with a design adapted to available steel shapes. This attempt was made at considerable unnecessary expense in the design shown in Fig. 1.

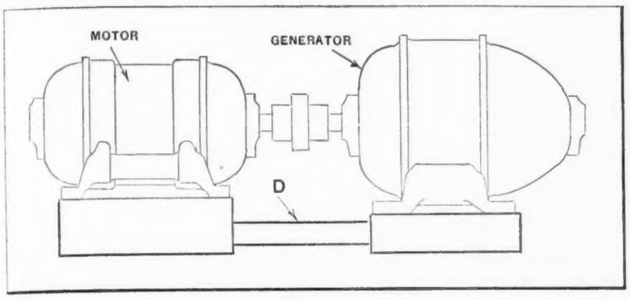


Fig. 5. Box-type Base Design Connected as at D

In designing a structural steel welded bedplate, we should begin with the question: "What are the functions of the required structure?" These functions may be stated as follows: (a) To combine into one unit structure two or more separate pieces of machinery. (b) To hold these pieces of machinery in fixed and definite relative positions. (c) To furnish a support for different positions and arrangements of feet of the respective pieces of machinery, and reduce them to a common floor level.

Beginning with (c), we may consider a simple case of forming a bedplate for a motor and a generator with shafts coupled together end to end. The two machines may present an appearance as shown in Fig. 2. The base or bedplate will require a certain minimum thickness. In Fig. 3, we will let *A*

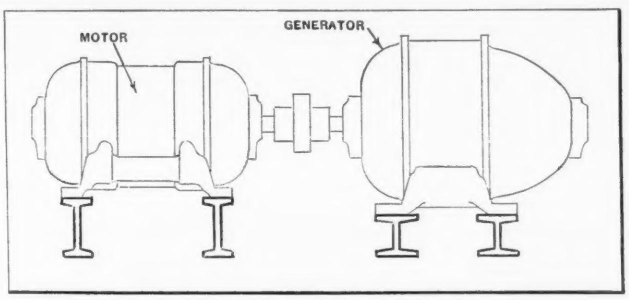


Fig. 6. Using I-beams and H-beams for Welded Bases

represent the floor line. Obviously, the bedplate must extend *B* inches from the feet of the motor to the floor, and *C* inches from the feet of the generator to the floor. If a block or box of suitable height were placed under each machine, as in Fig. 4, function (c) would be fulfilled. However, in order to fulfill functions (a) and (b), some connection must be made between the two blocks or boxes shown supporting the two machines, as at *D* in Fig. 5. Any type of connection that will enable the whole set to be lifted as a unit will fulfill function (a), but in order to hold the machines in fixed and definite relative positions, as under (b), the connection must be such as to give sufficient rigidity to the structure to prevent appreciable deflection

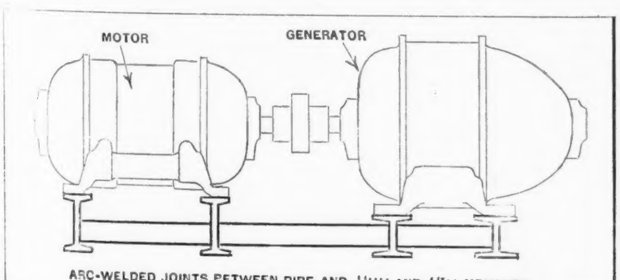


Fig. 7. Connecting Base Beams by Means of Piping

under conditions to which the set may be subjected, either in handling or during normal operation.

The next step in the solution of the problem is to determine how the steel shapes available can be made to fulfill the three requirements. Instead of placing a block or box under each machine, a rolled H- or I-section may be placed at right angles to the shaft under each pair of feet, as in Fig. 6. The only remaining step is to join these I- and H-sections rigidly. The simplest method, and at the same time the one that will give the greatest rigidity for a given weight, is the use of pipe members passing through the webs of the center H and I members

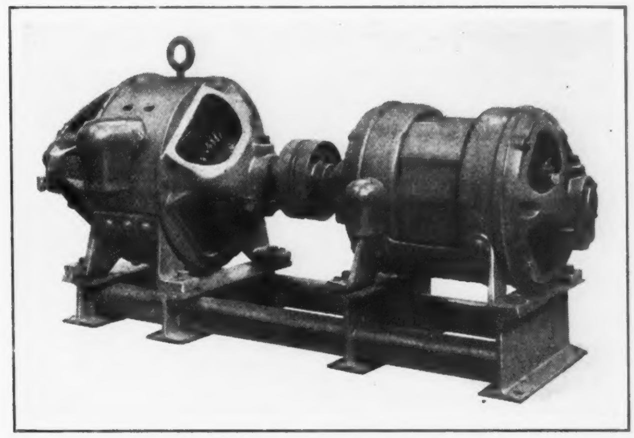


Fig. 8. Completed Base of the Type Shown in Fig. 7

and abutting against the webs of the end H and I members. A simple fillet weld at the joints converts the loosely assembled parts into a light, rigid, strong, and durable structure which will fulfill all the requirements. The completed bedplate is shown in Fig. 7. An actual photograph of such a bedplate, with motor and generator mounted on it, is shown in Fig. 8.

Quite often the difference in height between available rolled-steel sections will not meet the requirements of the machines exactly. In these cases, it is a simple matter to make up the difference by using pieces of flat, cold-rolled steel bars between

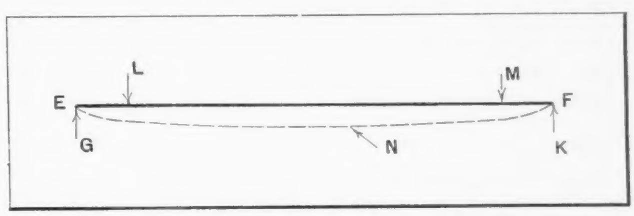


Fig. 9. Diagrammatic Sketch Indicating Deflection of Baseplates

the feet of one of the machines and the steel members that must support them. In addition to these, thin sheet-steel liners may be required to give accurate alignment of the machines. When the machines are bolted to the bedplate structure, the plates and shims will be securely and permanently held in position. The bedplate may then be bolted down to the foundation or grouted-in in the usual manner.

Although it is not practicable to make a bedplate so rigid that it will prevent all deflection and distortion due to handling or bolting down to an uneven surface, it is desirable to secure sufficient rigidity to avoid distortion caused by the weight of

the apparatus mounted on it during handling and shipping, and especially to have sufficient strength and elasticity to avoid permanent distortion as a result of abuse or accident in handling. In order to make the most efficient use of the materials, it is important to consider the stresses to be resisted.

If we represent a bedplate by line *EF*, Fig. 9, and assume supports at *G* and *K*, and concentrated loads at *L* and *M*, the bedplate will deflect or sag, as represented by the dotted line *N*. A condition of this kind is involved when the set

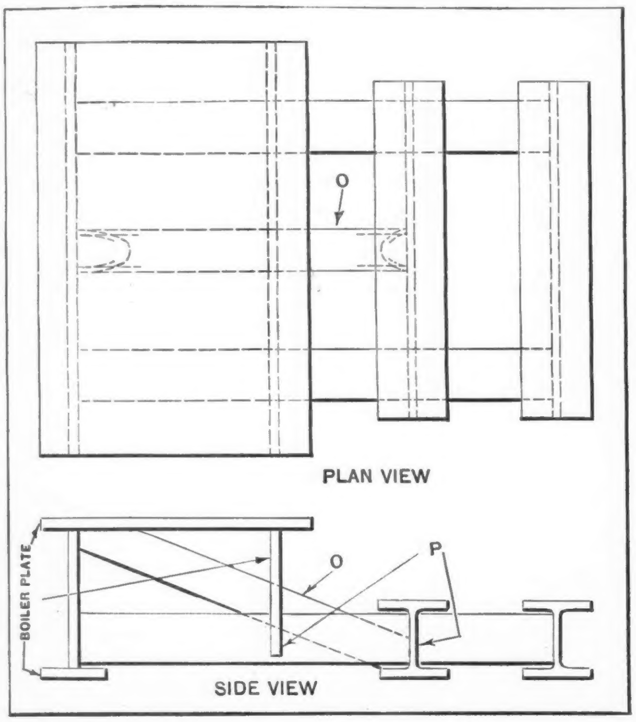


Fig. 10. Suggested Structure when There are Great Differences in the Heights at which Machines are to be Supported

is being lifted or when it is blocked up for grouting in place. It is necessary, therefore, that the longitudinal members be of sufficient strength and stiffness to hold this deflection to a figure that will not result in the bedplate assuming a permanent deformation and that will not interfere with the proper operation of the machines.

Another tendency to distortion, and one likely to be overlooked, is that of twisting of the whole bedplate structure due to the fact that it rests on an uneven foundation or to lack of uniform support in handling. This tendency can be resisted effectively by providing great torsional strength in the longitudinal members. As a pipe section possesses

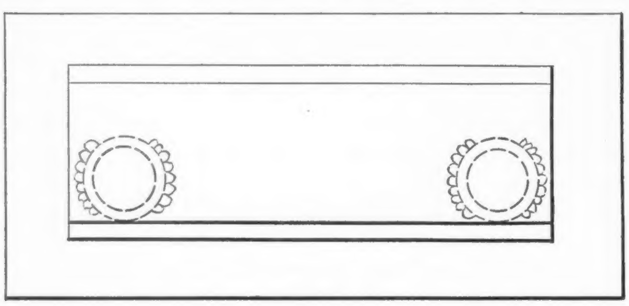


Fig. 11. Symmetrical Arrangement of Welds

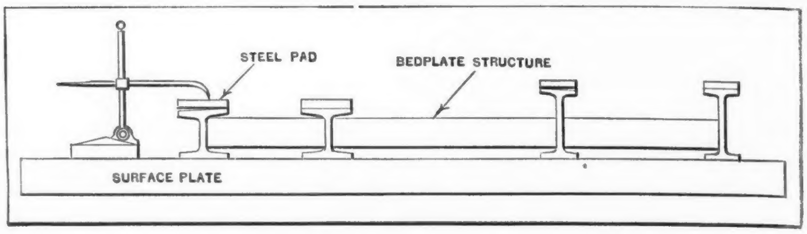


Fig. 12. Using Steel Pads for Leveling Supporting Surfaces

the greatest possible torsional strength and rigidity for a given weight, it is evident that the construction described in an earlier paragraph is ideal from this standpoint.

Where a great difference in center heights of machines exists, a modification of this design may be employed, as illustrated in Fig. 10. This shows a case where the end of the bedplate is of such a height that suitable I-sections are not available. Here, pieces of boiler plate are employed as a substitute. Great rigidity is secured by the addition of a pipe section bracing member located as at *O*.

In fabricating structures by welding, it is always necessary to make the welds as symmetrical as possible, in order to avoid warping. If the end view of a pipe and rolled section bedplate is as represented in Fig. 11, it is important to weld on both sides of the pipe, as shown, symmetrically disposed about the vertical center lines through the pipes. If the pipe is so close to the lower flange of the rolled section that the weld cannot be carried around at the lower side, welding should be omitted from the corresponding top section of the pipe, as well, even

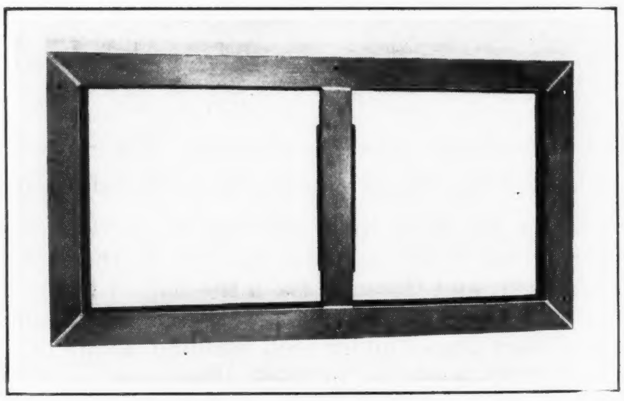


Fig. 13. Type of Welded Base that is Less Rigid than the Designs Shown in the Preceding Illustrations

though there be plenty of space between the pipe and the top flange. This is particularly important at intermediate positions, as at *P*, Fig. 10.

As a further guard against warping, intermediate welds should be made first and end members should be welded in place last. Furthermore, symmetrically placed welds should be of the same size and length. The members to be welded together should be clamped in position on a level surface plate.

If the foregoing suggestions are followed, it will usually be unnecessary to plane or mill the bottom of the bedplate. However, as the rolled sections available are not always true to form when received, it may be necessary in some cases to take a light cut from the upper surfaces. If no machine tool is available, sufficiently level and true upper surfaces may be obtained by placing steel pads cut from

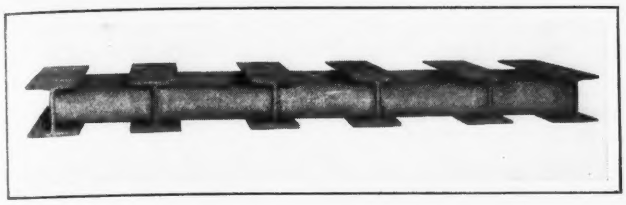


Fig. 14. A Welded Base for Supporting Three Machines

cold-rolled flat bars at all points where the feet of the machines rest, shimming them to the correct position, as may be required, and welding them to the main bedplate structure. The correct position of the upper surfaces of these pads may be determined by placing the bedplate on a suitable surface plate and adjusting them to a surface gage resting on the surface plate beside the bedplate and having its indicating point free to move over all points of each pad in rotation (see Fig. 12).

The foregoing paragraphs describe the method of producing a highly efficient bedplate or machinery base structure having many advantages over the cast-iron type which it is displacing, and even over other types of steel section bedplates, such as shown in Fig. 13. Although the bedplate requirements of a two-unit, coupled set, such as shown in Fig. 2, present one of the simpler problems in bedplate design, the principles briefly set forth here may be extended to cover even the most complex requirements. Some of these are suggested in Fig. 14, where a set of three units of uniform height are provided for, and in Fig. 15, where a support for a small exciter is formed by extending the longitudinal pipe members to suit.

* * *

There were fewer passengers carried on the railroads of the United States in 1927 than in 1911. Sixteen years ago the number of passengers carried was 938,655,000. In 1927 this figure was reduced to 829,845,000. The largest number of passengers ever carried by the railroads was in 1920, when the number rose to 1,235,000,000. The distance traveled per passenger, however, is greater at the present time than in 1911, so that the actual passenger miles at the present time are about 4 per cent greater than sixteen years ago. The number of passenger miles traveled in 1927 was, however, less than for any year since 1916. It is of interest to note that there has been an increase in the number of passengers and mileage traveled in sleeping and parlor cars; the falling off has been entirely in coach travel.

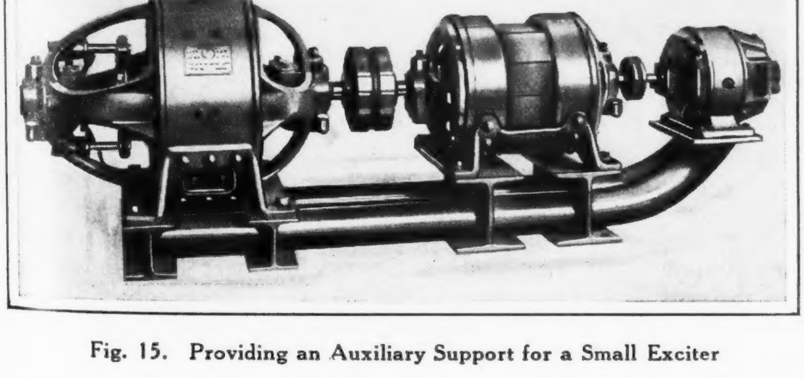


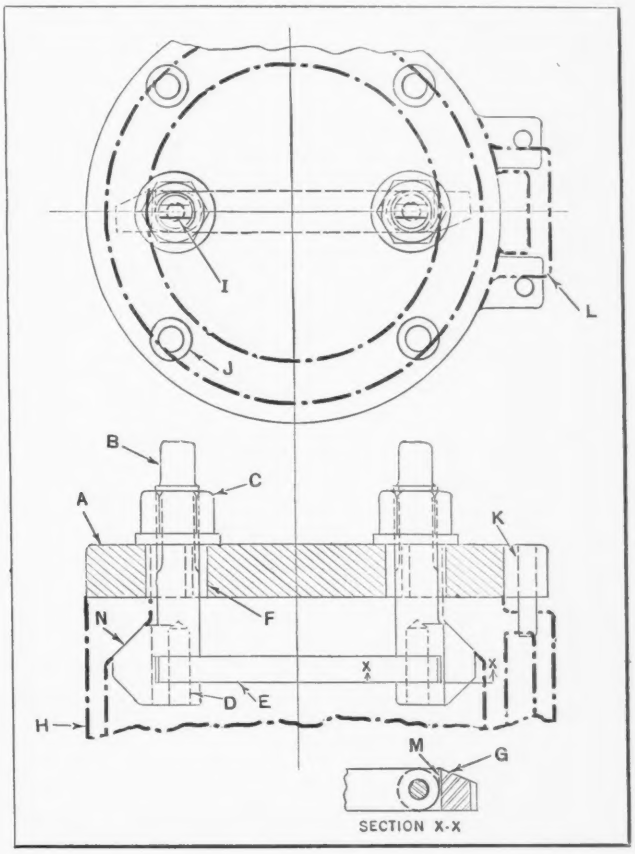
Fig. 15. Providing an Auxiliary Support for a Small Exciter

FLANGE JIG WITH FLOATING HOOK-BOLTS

By J. E. FENNO

The accompanying illustration shows an improved type of jig for drilling flanged tanks. The design is interesting, inasmuch as it permits a positive grip by the hook-bolts on the sloping surface of the flange at N, and also allows the jig plate A to be shifted about to match the contour of the flange on tank H. The tie-link E was incorporated to take the pressure set up when the collar-nuts C are tightened. Both ends of this link are a swing fit on the pins D, the latter being driven into the hook-bolts.

In operation, the flattened tops B of the hook-bolts are grasped by the thumb and forefinger of each hand and are twisted in a left-hand direction until the hook-bolts are at right angles to the link E. This allows the bolts to pass freely through the circular opening in the tank. The bolts are next twisted back to their former position, the plate A being located by pins K outside the tank projection L. After matching the jig plate with the casting, the nuts C are tightened. The hook-bolts are prevented from turning in the right-hand direction by the link corners M shown in section X–X. When the collar-nuts C are tightened, the tank is ready to be drilled, using the bushings J as guides for the drill. The hook-bolts are beveled, as shown in section X–X, for clearance when they are lowered through the flange opening. A jig of similar design can be used for square openings.



Jig Used in Drilling Flange of Tank

CARE OF REAMERS AND COUNTERBORES

By JACOB H. SMIT

Reamers can cause much trouble and expense if of poor quality or improperly cared for. Unsatisfactory cutting action may be due to several causes: The reamers may be too soft; there may be hard spots in the castings or forgings reamed; the speed of the tool may be too high or the cutting edges may not be sharpened properly.

The comparative frailness of the cutting edges of a reamer should always be taken into consideration. If the cutting speed is too high, as is often the case, the cutting edges will wear too fast at the front where the cutting is done and where the strain is greatest. In a short time, the front edges wear to such an extent that the contact surface is back of the edges that are supposed to do the cutting. This may develop so much friction in the case of a machine reamer or a rose reamer that it will dig in and produce a torn-out hole, or it may even break if not stopped quickly. Tools such as reamers, counterbores, or expensive form cutters should not be run up to the limit of their cutting speed, if smooth holes are desired and the tool is to have a long life.

To prevent breaking reamers, it is good practice, when reaming holes by power, to slacken the belt tension, so that any strain greater than that actually needed to ream the holes will throw off the belt. If a reamer becomes caught or wedged in a hole, it should be carefully pulled backward and forward slightly by hand. In many cases the reamer can be freed in this way without breakage or damage. If the reamer cannot be loosened by hand, it may be advisable to unscrew the chuck and drive the reamer out of the hole from the back of the work.

Reamers that are worn below size or do not cut properly can sometimes be reclaimed by rubbing a hardened screwdriver lengthwise of the flat sides of the cutting edges, allowing the flutes to guide the screwdriver. The diameter of the reamer can often be increased and the cutting action improved by this treatment. The diameter of a reamer can also be increased by peening.

Some years ago, the writer had two high-speed cutters about 1 1/2 inches in diameter by 1 1/4 inches long, which were used simultaneously for line-reaming. As these cutters were solid, they were declared useless and new ones ordered when their edges became worn below a certain size. Not liking the idea of throwing these reamers away, the writer decided to experiment with them. Accordingly, one of the reamers was clamped in a vise and the whole length of each cutting edge peened. The size was thus increased over 0.002 inch. A blunt-end chisel was used for the peening operation. A little stoning after peening put the reamers in shape for use.

Whenever the cutting edges became worn below size, the peening process was repeated. This was done at least eight times. Care must be taken to give only light blows when peening reamer blades. It is well to experiment on a useless reamer at first in order to find out how heavy a blow the reamer edge will stand without breaking. The peening should start at the back of the blade, great care being taken as the cutting edge is approached.

The action of a new reamer will be smoother if the blades are unevenly spaced so that the cutting edges are staggered. It is a good practice to loosen the clamping screws in the slotted body of expansion or inserted-blade reamers when they are not in use or when they are placed in storage. Some reamers are very hard and brittle, and the change in temperature overnight may set up strains in the bodies of the reamers which will cause them to crack if the clamping or adjusting screws are not loosened. It is always well to bear in mind that steel becomes more brittle when cold. Some shops make it a rule to have the adjusting screws loosened before the reamers are returned to the tool-room.

For some kinds of work, it is very important that the proper kind of lubricant be used. In reaming ordinary machine or carbon tool steel, lard oil or a suitable cutting compound can be used.

Some toolmakers, when drilling a dowel-hole in one of the alloy steels employed for lamination dies, use an under-size reamer first, without lubricant, and follow this up by using an expansion reamer. If a very smooth hole is desired, the reamer must be very sharp and should be wiped with a piece of slightly oily waste. This provides all the lubricant required and no more should be used. Neatsfoot oil generally gives good results. After a few holes are reamed, the reamer must, in many cases, be stoned slightly to prevent tearing. In grinding rose reamers, do not let the grinding wheel run off the front end of the reamer, as this causes the end to become convex. A reamer thus ground will stick in the hole, due to the fact that the cutting is done at the front edge. This precaution is particularly important when the grinding machine bearings are worn.

* * *

DIRECT STEEL-MAKING IN SWEDEN

At a conference of mining engineers in Sweden, H. Flodin, the inventor of the direct steel-making process which bears his name, gave some particulars of what has been done so far to bring this process in line with practical requirements. The speaker referred to experiments which have been going on since 1923, and to the principles on which the process is founded. The latter comprise, briefly, the smelting of the iron-ore in the form of briquettes in an electric furnace whereby steel is obtained directly, eliminating the intermediate stage of making pig iron.

The ore of which the briquettes are made must be ground to a fine powder, and mixed with lime before the pressing. After a period of trials with an experimental furnace, a larger one for a charge of about 300 pounds was erected. At first it was found impossible to produce a material which did not have to be refined further in an open hearth furnace, but as the experiments went on, it was found that the carbon content could be regulated without difficulty by mixing high and low carbon briquettes. The furnace constructed as a result of these discoveries has a capacity of fourteen tons per day and has been in operation for several years. The process has been improved continuously, both as regards the quality of the product and the consumption of charcoal and electric current.

Pressure Charts for Thrust Bearing Design

Results of Tests Made to Determine the Feeding Pressure Necessary to Force Drills Through Different Kinds of Materials

By ALFRED M. WASBAUER

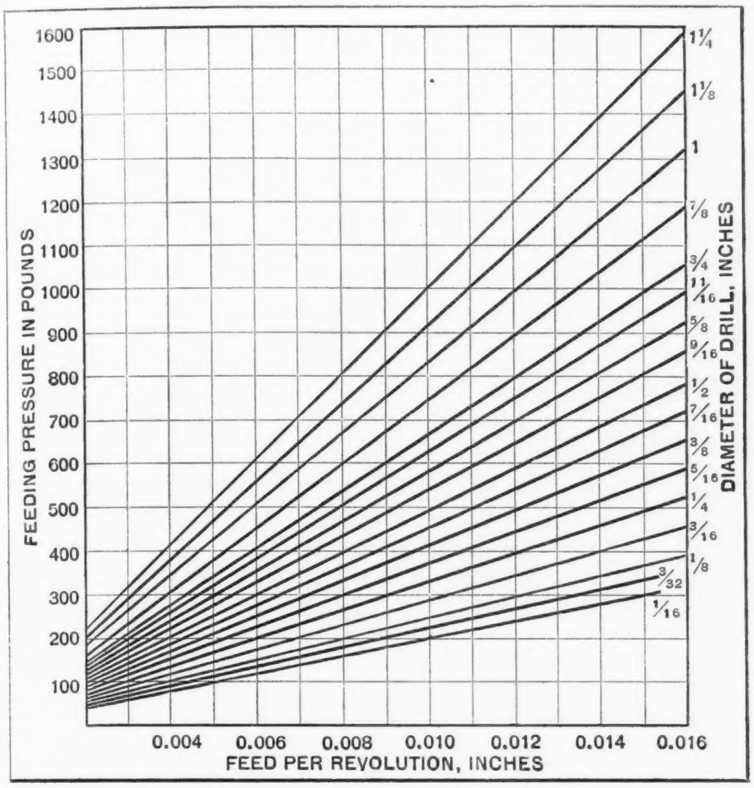


Fig. 1. Pressure Required for Feeding Drills in Cast Iron

IN standardizing the designing practice for multiple-spindle drilling heads, it was found rather difficult to specify suitable thrust bearings for the drill spindles, particularly when the close grouping of the spindles limited the space available for the bearings. As very little data or information was available on which to determine the proper size and type of bearing, actual tests under working conditions were made and the results incorporated in the accompanying charts.

The tests were made by placing a large platform scale on the bed of a radial drill and resting the test block to be drilled on the platform of the scale, so that the pressure of the drill would register directly on the scale. In this way, it was impossible for any errors to creep in. Readings were taken at various feeds with drills ranging from 1/16 inch to 1 1/4 inches in diameter, and the charts plotted from these readings. New Cleveland "Clefor" drills were used in all tests, as their machine-ground points eliminated all possible variations due to incorrect sharpening.

The nearest approach to the readings obtained in making the tests were found on page 872 of MACHINERY'S HANDBOOK, which gives the horsepower consumed in feeding high-speed steel drills. By converting the horsepower into pounds pressure, values were obtained which were from 20 to 40 per cent higher than the test readings given in the charts. The values given in MACHINERY'S HANDBOOK may have been based on results obtained with drills having a wider point, which would account for the difference in values. Formulas from other sources gave values three or four times too low, and it is to be expected that trouble would develop as a result of using thrust bearings of too low capacity.

The charts are all based on the results obtained with sharp drills having normal points. The chart Fig. 1 gives the pressure required for feeding drills in cast iron. A factor of safety of 1.5 should be allowed for dull drills.

The chart Fig. 2 gives the pressure required for feeding drills in 30 per cent semi-steel. A factor of safety of 1.5 should be allowed, in this case also, for dull drills.

The chart Fig. 3 gives the required feeding pressure when drilling S. A. E. No. 1020 bar steel, using sharp drills hav-

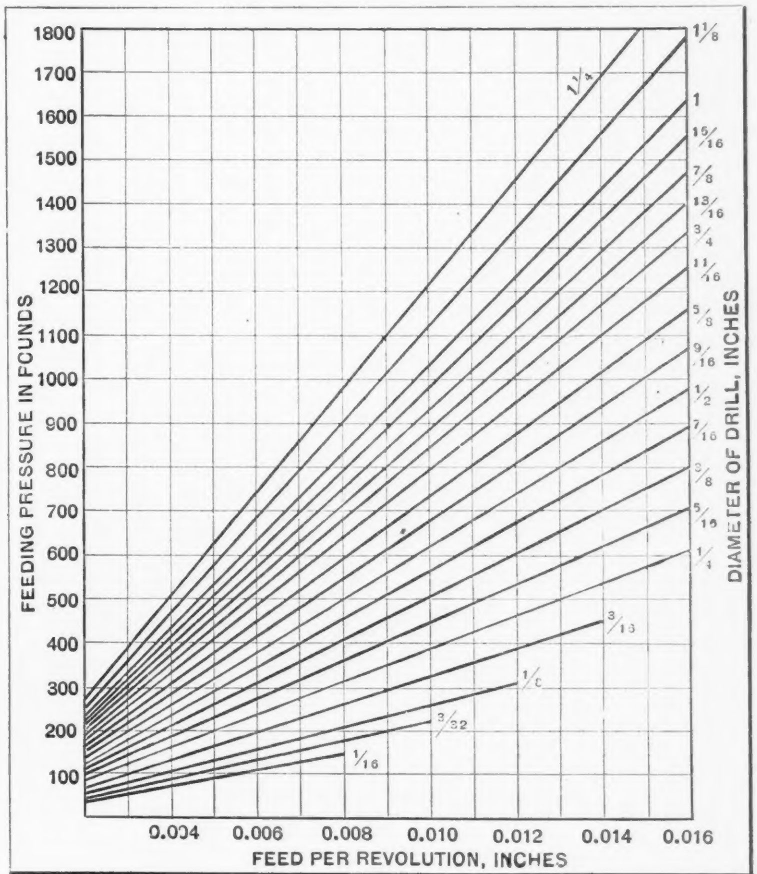


Fig. 2. Feeding Pressure Required in Drilling 30 Per Cent Semi-steel

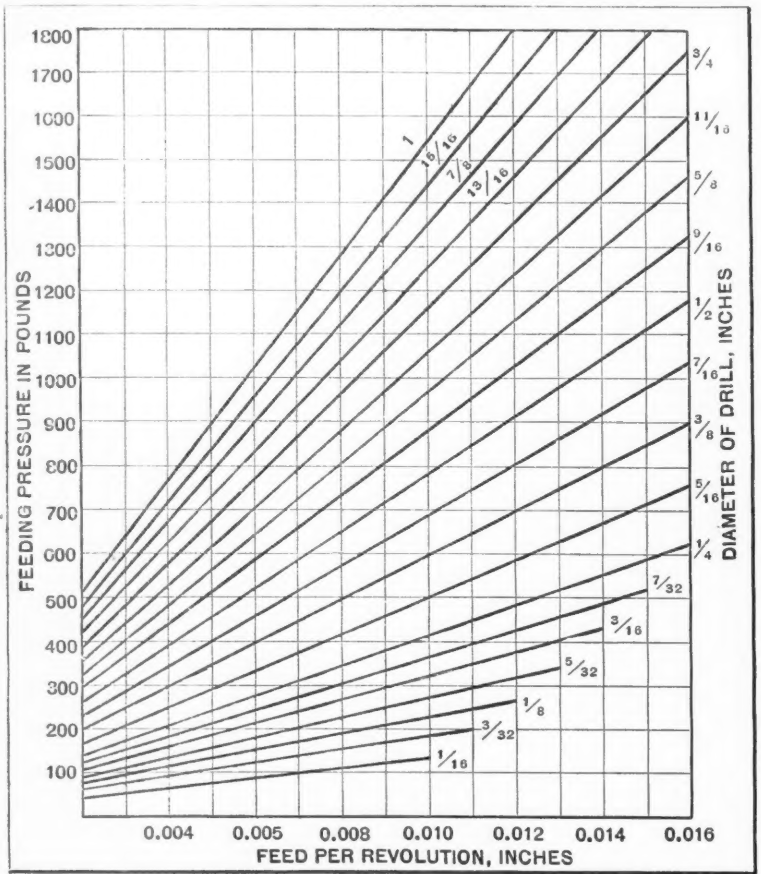


Fig. 3. Pressure Required for Feeding Drills in S. A. E. No. 1020 Bar Steel

INVAR AND OTHER NICKEL ALLOYS

Nickel steels of high nickel content have rather remarkable properties. A nickel steel containing 36 per cent of nickel, generally known by the trade name Invar, has the lowest coefficient of expansion of any metal alloy known. By varying the amount of nickel, it is possible to obtain alloys with an expansion suitable for almost any application. For example, an alloy containing from 42 to 44 per cent of nickel has a coefficient of expansion equal to that of glass.

High elasticity of the alloy may be obtained by adding to an Invar alloy about 12 per cent of chromium, together with a small quantity of tungsten, carbon, and manganese. This alloy is known by the trade name Elinvar.

Because of its low coefficient of expansion, Invar is used extensively for tape and wire measures and in instrument construction. Elinvar is used, among other things, for watch springs—5,000,000 springs are now manufactured annually from this material.

Platinite is another of these nickel alloys. It has the same expansion as platinum, and hence, finds application as a substitute for that metal when applied for sealing-in leads for electric light bulbs.

An alloy known as AMF, containing from 55 to 60 per cent of nickel, 0.33 per cent of manganese, and 0.2 to 0.4 per cent of carbon, has a coefficient

ing normal points. In drilling this steel, the pressure is unaffected by the use of lubricant. Again, a safety factor of 1.5 should be allowed for dull drills. The data on which this chart is based were obtained in drilling a test piece of S.A.E. No. 1020 bar steel of 28 scleroscope hardness.

Referring to the chart Fig. 4, we have the pressure required for feeding drills in S.A.E. No. 1070 bar steel of 35 scleroscope hardness. The tests were made with sharp drills having normal points, using a lubricant. A factor of safety of 1.5 should be allowed for the increased pressure required when the drills become dull.

The chart Fig. 5 gives the pressure required for feeding drills in S.A.E. No. 3140 steel of 45 scleroscope hardness. Sharp drills having normal points and supplied with a lubricant were used in obtaining the data on which this chart is based.

* * *

"If I were to prescribe one process in the training of men fundamental to success in any direction," says Eugene C. Grace, president of the Bethlehem Steel Co., "it would be thoroughgoing training in the habit of accurate observation." The ability of saying "yes" at the right time and "no" at the right time, explains Mr. Grace, is the ability that measures a man's business success, and this ability to judge wisely is usually coincident with the ability to observe accurately.

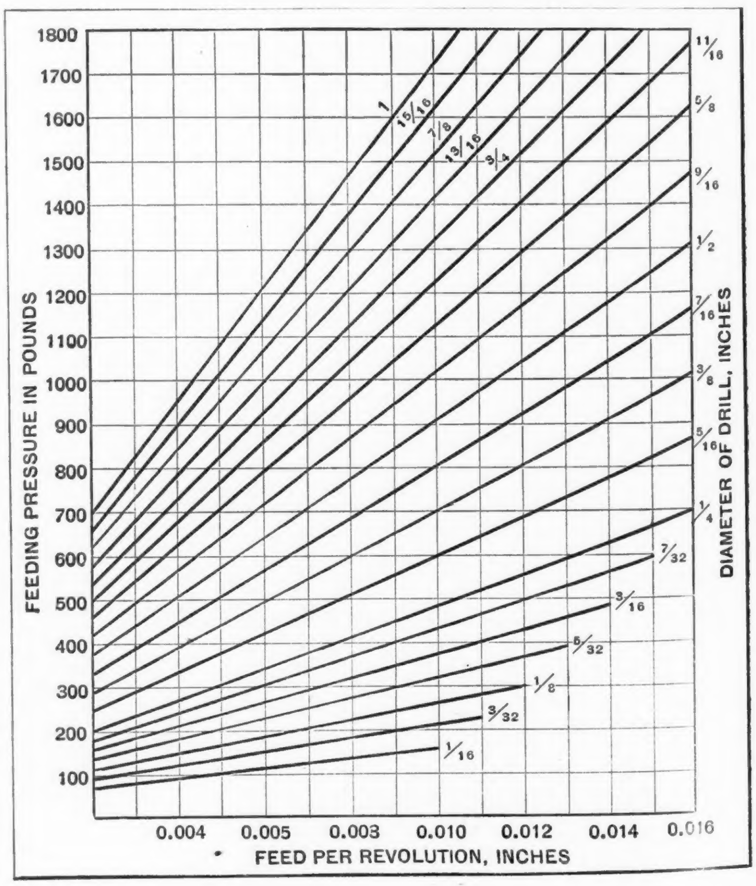


Fig. 4. Required Pressure for Feeding Drills in S. A. E. No. 1070 Bar Steel

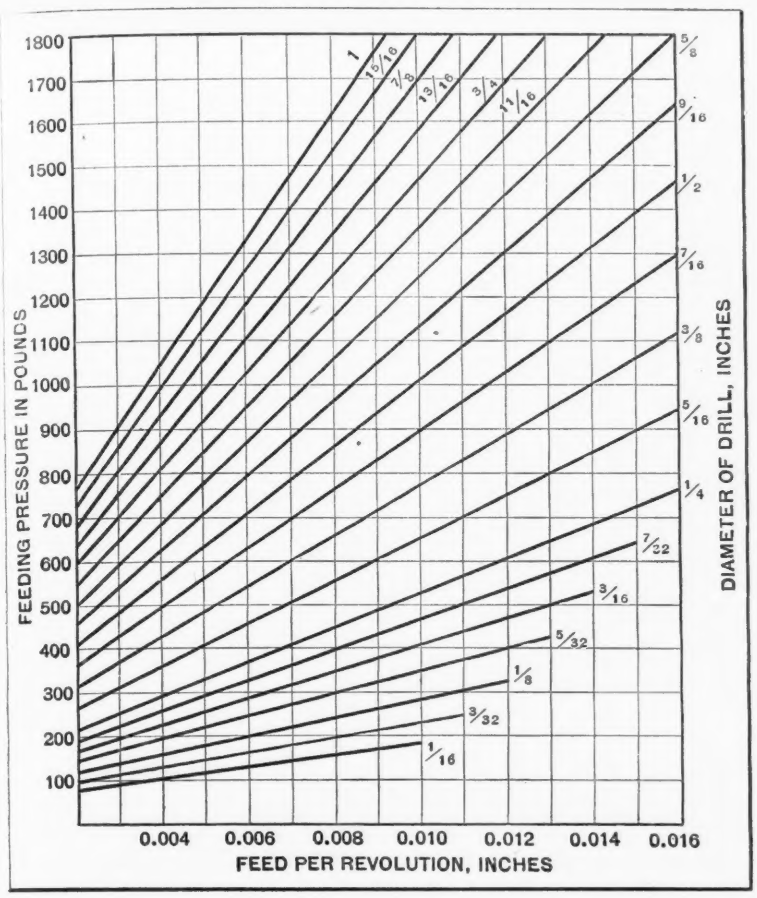


Fig. 5. Pressure Required for Feeding Drills in S. A. E. No. 3140 Steel

of expansion approximately equal to that of steel, but has the advantage of great ductility and resistance to shock at very low temperatures. It is, therefore, used for such applications as valves used in liquid air plants.

* * *

RECORD OF CHANGES IN DRAWINGS

By PAUL SCHVOM

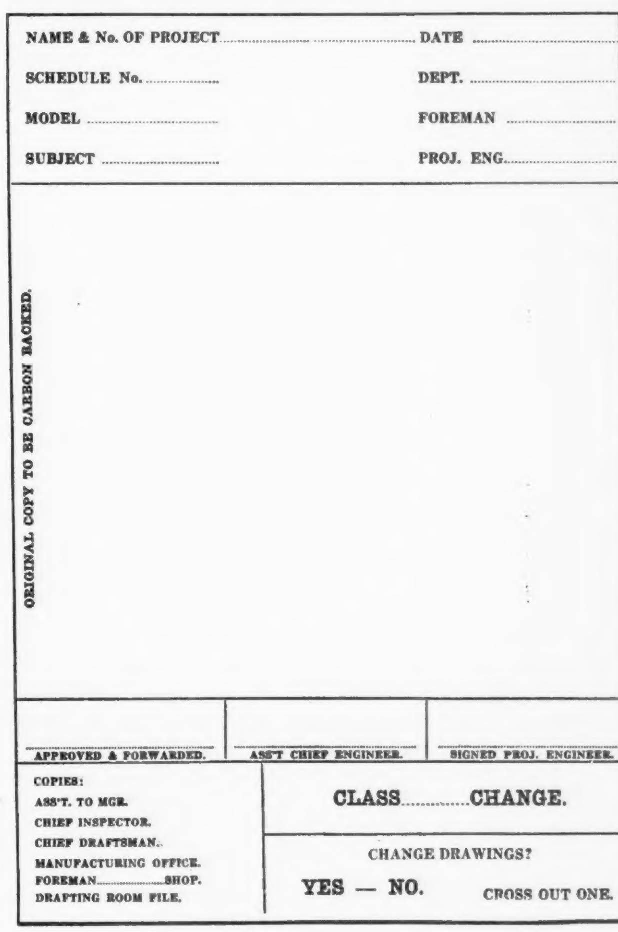
During the construction of a machine or the production of parts, differences of opinion often occur in the shop regarding the proper procedure. Variations between the actual construction and the specifications on the blueprints also appear frequently. The draftsman may have overlooked some detail or the shop may have deviated a little from the drawing specifications, yet not a sufficient amount to warrant the scrapping of the part. In one plant, all such cases are successfully handled by having the project engineer decide what shall be done. On making his decisions, he issues a project slip on a blank such as shown in the accompanying illustration, which covers the points involved.

If the draftsman has overlooked some detail, the instructions needed to enable the work to proceed are written down on the project slip by the engineer. The carbon copy of this slip is handed directly to the foreman of the shop. Thus, the work proceeds without any delay or change in the production schedule. This means a big saving over the old method of having draftsmen correct the drawing, issue new blueprints through the planning section, and attend to any other routine work ordinarily required before the work can proceed. With the new system, the project engineer checks off the names of those to whom copies of the slip are to be sent. The slips are kept in the drafting-room, and when time is available, the drawings are corrected to agree with the corrections made by the project engineer and recorded on the slips. In the meantime, the work proceeds in the shop according to directions.

When a part has been machined in some manner not strictly in accordance with the specifications on the drawing, and the foreman knows that it will serve its purpose satisfactorily, although it would ordinarily be rejected by an inspector, he calls in the project engineer and explains the matter to him. The project engineer, realizing that considerable money and labor have already gone into the part, may decide that it should be used and, accordingly, issues a project slip to the foreman, who attaches it to the part in question. This slip bears an explanation for the inspector to the effect that the part may be used. In a case of this kind, no copy of the slip need go to the drafting-room, as no change in the drawings is required and all future parts of the same kind are made in accordance with the drawing specifications.

* * *

Standardization is common sense applied to creative individualism for the purpose of achieving the greatest good for all.



NAME & No. OF PROJECT .... DATE ....
SCHEDULE No. .... DEPT. ....
MODEL .... FOREMAN ....
SUBJECT .... PROJ. ENG. ....

ORIGINAL COPY TO BE CARBON BACKED.

APPROVED & FORWARDED. | ASS'T CHIEF ENGINEER. | SIGNED PROJ. ENGINEER.

COPIES:
ASS'T. TO MGR.
CHIEF INSPECTOR.
CHIEF DRAFTSMAN.
MANUFACTURING OFFICE.
FOREMAN .... SHOP.
DRAFTING ROOM FILE.

CLASS .... CHANGE.

CHANGE DRAWINGS?
YES — NO. CROSS OUT ONE.

Project Slip Which Gives Instructions for Changing Work or Drawings

Notes and Comment on Engineering Topics

There are at present 7000 motor bus lines in the United States, operating approximately 85,000 buses and carrying 2,500,000,000 passengers a year.

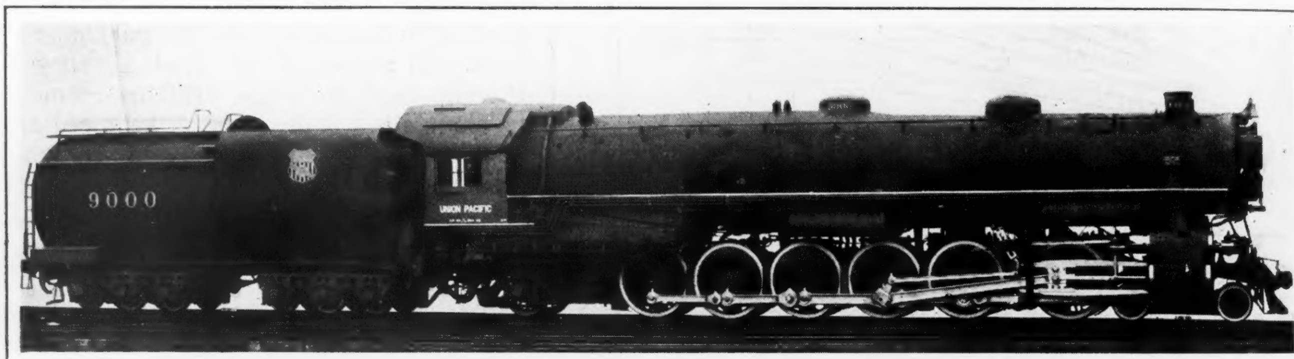
The longest tunnel in the United States, an eight-mile bore through the Cascade range 100 miles east of Seattle, has just been opened for operation by the Great Northern Railroad. Coincident with the opening of the tunnel, the Great Northern's entire route through this mountain range, a distance of 75 miles, will be changed from steam to electric operation. The tunnel cost about $14,000,000 to drive, and including the electrification and other improvements, the total expenditure on the project has been $25,000,000. The new Cascade tunnel is nearly two miles longer than the Moffatt tunnel in Colorado recently completed, and is exceeded in length only by four other tunnels in the world, the Simplon, St. Gothard, Loetschberg and Mount Cenis tunnels, all in the Alps. The longest of these, the Simplon, is over twelve miles in length.

The Committee on Cast Iron of the American Foundrymen's Association is planning to conduct an investigation on the methods of measuring liquid shrinkage of cast metals. The work will be carried on at the Bureau of Standards, Washington, D. C., where a research fellowship has been established for the special purpose of investigating these test methods. Tests for solid contraction are available at the present time. The Bureau of Standards is also working out tests to measure fluidity, and the present project, that of formulating test methods to measure liquid shrinkage, completes this group of tests.

A new aluminum alloy known by the trade name Hyb-lum, which is claimed to combine lightness and strength to an unusual degree, has been placed on the market by the Sheet Aluminum Corporation of Jackson, Michigan. Among the claims made for Hyb-lum are that it has a pleasing color, is non-tarnishing and non-corrodible, resists chemical action and intercrystalline corrosion, is weldable, has a low specific gravity, strength and plasticity, resists fatigue, is not sensitive to moderate temperature variations in heat-treatment, and is stable after heat-treatment even at high temperatures. Hyb-lum comes in four different grades, varying in ultimate strength from 20,000 to 65,000 pounds per square inch.

The specific gravity of Hyb-lum is 2.73 and the electric conductivity is 45 to 50 per cent that of copper. Heat-treatment of Hyb-lum consists of quenching in cold water from 900 to 975 degrees F. for a period of from 12 to 24 hours. The alloy is then annealed at from 600 to 1000 degrees F.

Hyb-lum products comprise flat, coiled and strip sheets, sheet circles, extruded structural and special shapes, moldings, bars and rods, wires and rivets, stampings, screw machine products, and forgings. In addition, ingots for die-castings, permanent mold and sand castings are obtainable.



One of the latest giant engines built by the American Locomotive Co. for the Union Pacific Railroad; provided with three cylinders; one, 27 by 31 inches, and two, 27 by 32 inches; twelve driving wheels, 67 inches diameter; weight on drivers, 354,000 pounds; total weight of engine, 495,000 pounds. Tractive power, 96,600 pounds. Length, over 100 feet

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The airplane carrier *Saratoga,* a sister ship of the *Lexington,* at test runs outside of San Pedro, Calif., achieved a speed of 34.99 knots, or approximately 40.5 miles per hour. The displacement of this vessel is 33,000 tons and to propel it at this speed, the motors supply 215,581 horsepower to the propeller shafts. The ship is provided with General Electric motors. It is estimated that when running at the high speed mentioned it would be impossible to stop the ship within a distance of less than one mile. Could trans-Atlantic passenger liners maintain a constant speed equal to that of the *Saratoga* during the trials, the crossing from New York to Liverpool could be accomplished in 3 days and 18 hours. When at its highest speed, the ship behaved in somewhat the same manner as a speed boat; the fore part of the ship lifted while the stern settled low in the water.

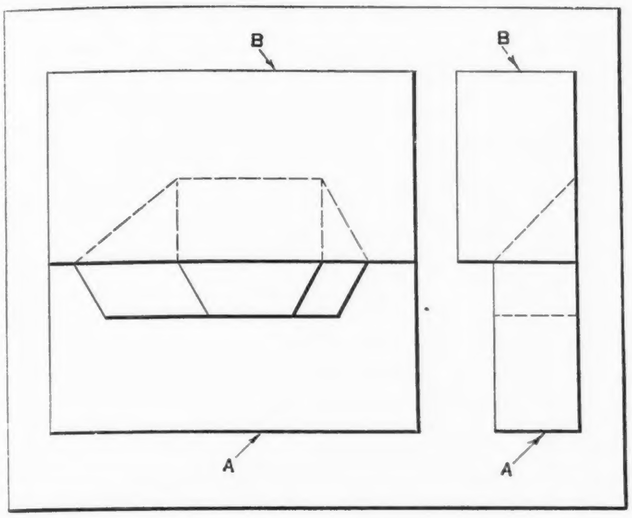

Fig. 1. Assembled Two-part Mold

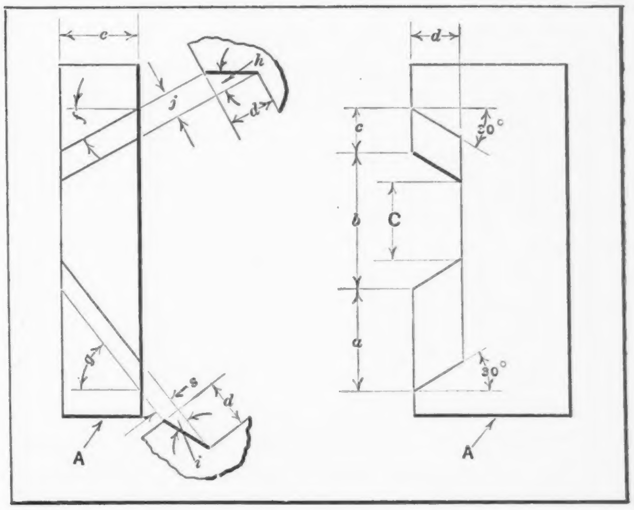

Fig. 2. Part A of Mold Shown in Fig. 1

Making Drawings for Complicated Molds

The Design of Molds for Parts Made from Materials Such as Bakelite Presents Many Difficult Problems

By J. HOMEWOOD

THE production of molded parts from materials such as bakelite requires the use of carefully designed molds. Parts made from such materials are, in many cases, of very complicated design, and the construction of a satisfactory mold often presents interesting problems for the tool designer and toolmaker. After the exact shape of a part has been determined, the mold must be designed. When there are many irregular shaped recesses and angular surfaces, great care should be taken to have these details shown clearly and accurately on the working drawings of the mold.

Drawings that give all the dimensions required to determine the shape and size of a mold do not necessarily give the dimensions or angles required by the toolmaker who makes the mold. A properly made drawing should, with few exceptions, be so complete and explicit that the toolmaker can proceed with the machining and finishing operations without stopping to calculate angles or dimensions.

In many cases, the correct working angles can be shown to the best advantage by making fragmentary auxiliary views such as those shown in Fig. 3 for the angles w and z. By providing a suffi-

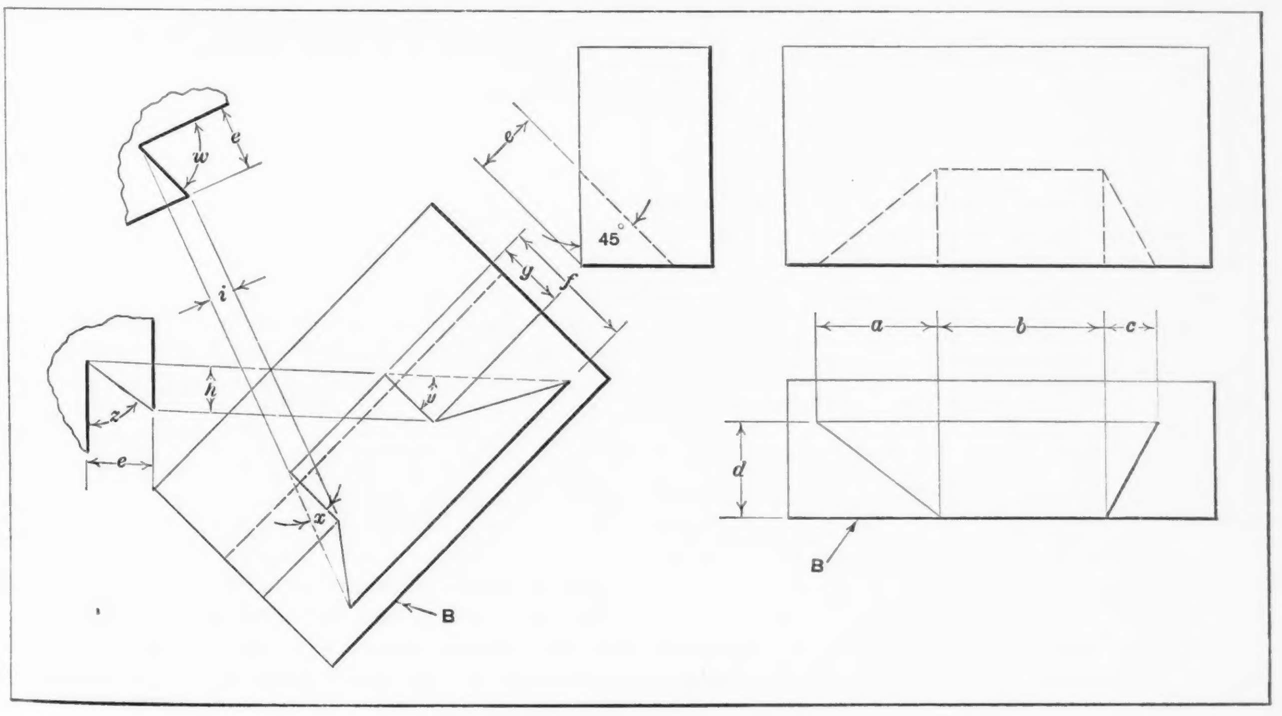

Fig. 3. Part B of Mold Shown in Fig. 1

cient number of correctly dimensioned auxiliary views of this kind, much time can be saved in the tool-room, and the danger of mistakes occurring through misunderstanding of the drawings is greatly lessened.

The two parts A and B, Fig. 1, were required to have their recesses or angular faces accurately matched. In Fig. 2 is shown the part A, in which the known dimensions are a, b, c, d, e and the 30-degree angle.

Assuming that the part is to be machined on a shaper, it is necessary for the workman to have the dimension C when roughing out the recess with angle x or angle y, depending upon which side of the angular slot or recess is being machined. The depth of the cut e is found by the equation:

$$e = d \times \sin 45 \text{ degrees}$$

We also have,

$$f = d \div \cos 45 \text{ degrees}$$

Now

$$\text{Tan } y = a \div f$$

and

$$\text{Tan } x = c \div f$$

In order to find the angles to which the shaper head must be set over, it is necessary to determine

Spur Gears

Internally Ground

Grinding Two Gears at a Time

On narrow work such as spur gears, it is of advantage and increases production very materially to hold and grind two pieces at a single setting.

Above shows our Size-Matic Internal arranged with a fixture for handling work in this manner. The fixture consists of a double sliding jaw collet chuck with individual sets of jaws that independently centralize both gears. Rolls are attached to the jaws for locating the gears by pitch line control.

This method of holding two gears at a time practically doubled previous production figures. See page 2.

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Fig. 1. Circular Printed for Distribution in English-speaking Countries

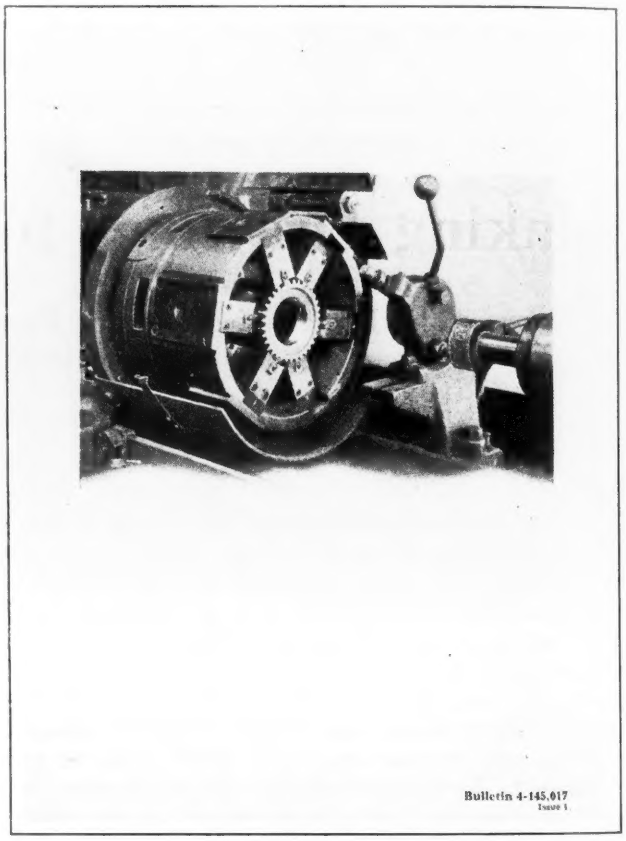


Fig. 2. Same Circular as Shown in Fig. 1, but with Text Matter Omitted

prior to rotating or tilting the vise to the angles f and g. Now

$$C = b - 2d \times \tan 30 \text{ degrees}$$

The angles f and g, to which the vise must be set, are obtained as follows:

$$\text{Tan } f = c \div e$$

and

$$\text{Tan } g = a \div e$$

The angles h and i to which the head must be tilted are next found. For these angles we have,

$$\text{Tan } h = j \div d$$

and

$$j = d \times \tan 30 \text{ degrees} \times \cos f$$

Also,

$$\text{Tan } i = s \div d$$

and

$$s = d \times \tan 30 \text{ degrees} \times \cos g$$

In Fig. 3 is shown the larger piece B, which is somewhat more difficult to produce. In machining this piece, the vise must be tilted to an angle of 45 degrees, after which it is rotated to correspond the dimensions h and i. We have,

$$h = g \times \sin y \text{ and } i = g \times \sin x$$

Now

$$\text{Tan } z = e \div h$$

and

$$\text{Tan } w = e \div i$$

Problems of this kind, while presenting no great difficulty for the expert draftsman, constitute interesting and practical examples for college students and those studying engineering drawing, as they make clear why it is desirable to indicate accurately the various angles and just how the angles are used in setting up the work for the required machining operations.

* * *

The Royal Air Force of Great Britain has adopted all-metal construction for airplanes as the standard for future construction. The adoption of metal exclusively for airplane construction is the result of years of experimentation and research on the part of the British aviation authorities.

PREPARING CIRCULARS IN FOREIGN LANGUAGES

The accompanying illustrations show how the Heald Machine Co., Worcester, Mass., simplifies the work of its foreign distributors in the preparation of circulars of grinding machines, magnetic chucks, and special grinding equipment, in foreign languages. After the circulars required for the English-speaking countries have been printed, a number of additional copies are run off on the printing press with the illustrations only, leaving off all text matter. These "blank" copies are then sent to the foreign dealers who can either fill in the space left open, on the typewriter, if only a few copies are required, or have the matter set in type and printed in the text matter space, if a large number of copies are needed.

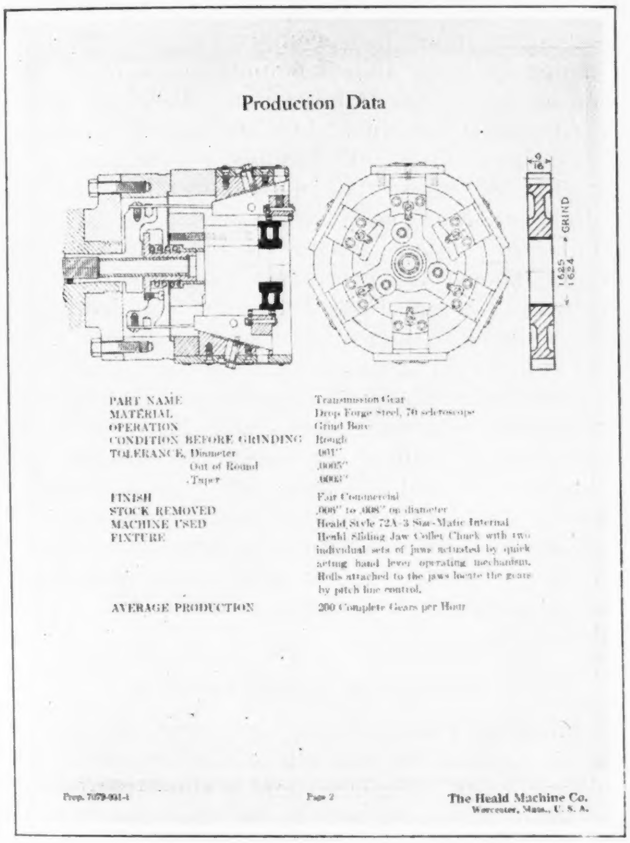


Fig. 3. Back of Circular Shown in Fig. 1, with Explanatory Text

This method saves sending electrotypes, photographs, or drawings abroad, for printing the circulars. Also, it saves the need for trying to translate accurately the descriptive matter into foreign languages and having it set and proofread in this country. The method is one that could probably be adopted to advantage by other firms that export machinery and equipment.

* * *

The exports of industrial machinery during 1928 showed a gain of about 15 per cent over 1927, the total exports exceeding $200,000,000. Of this amount, metal-working machinery was represented by about $35,000,000, an increase of 35 per cent over 1927. Lathes were exported to a value of nearly $4,500,000; milling machines, $2,200,000; and drilling machines, $1,600,000.

AN ADVERTISING MANAGER SPEAKS ON EDITORIAL PUBLICITY

In a talk before the Chicago Business Papers Association, C. R. Ege, manager of the advertising and publication bureau of the Portland Cement Association, gave expression to the progressive advertising manager's views on editorial publicity.

"A business publication," said Mr. Ege, "is valued for the news it contains. Its readers like well written editorial opinion. They want editorial opinions based on news facts. In the articles they want news facts, with less opinions.

"No editor can keep abreast of news facts if he is confined to his office. He must spend part of his time visiting the field about which he writes or about which he wants others to write. He must meet the men who do interesting things in the industry or the profession. So we advertising managers look for papers which have an editorial staff that travels and has a broad acquaintance in the industry. It means that the contributed matter is really news and will be told and illustrated in an interesting way.

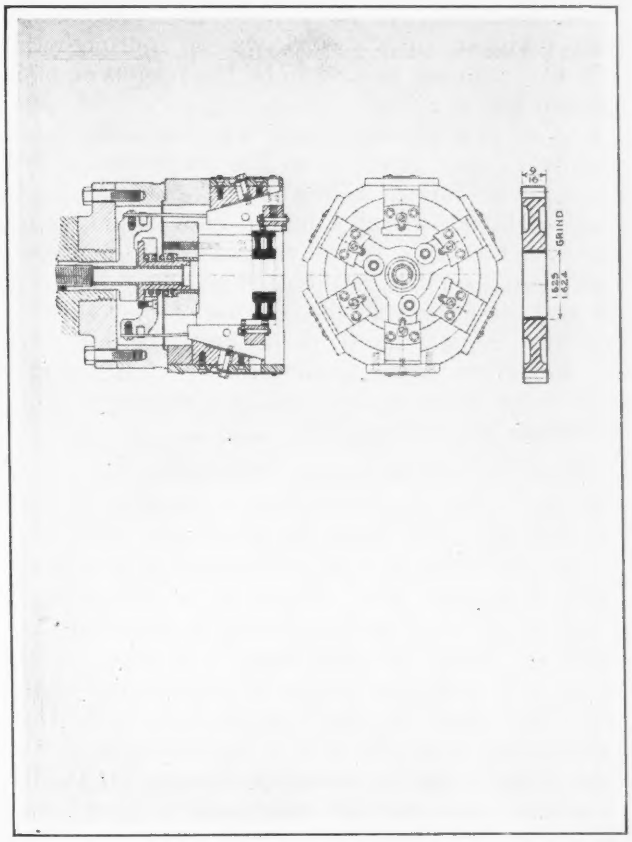


Fig. 4. Circular in Fig. 3 with Text Space Blank for Filling in Abroad

"Then we want to know what the attitude is toward publicity originating with advertisers. We want it to stand on its own feet. We do not want the publication to accept it because we are advertisers or it is hoped will become advertisers in that publication; and we crave the same attitude on the part of the editor toward our competitors."

* * *

Mr. O. S. McCurdy, who sent us a post card January 22, will greatly oblige the editor of MACHINERY by sending his address.

Machining Fabroil and Textolite Gears

Construction and Characteristics of "Fabric" Gears, with Detailed Instructions for Turning, Drilling, and Cutting Teeth in Gears of This Material

By H. D. RANDALL, General Electric Co., Schenectady, N. Y.

BACK in 1908, John Miller, chief millwright of the Schenectady Works of the General Electric Co., developed the first gear made of spinnable textile fibers held in a compressed state. The inventor's work was so thorough that this original gear proved to be the prototype of all modern fabric gears.

For several years Fabroil was the only fabric gear in use, but later, when the properties of synthetic resin—known as "Bakelite," and invented by Dr. Baekeland—became better known and appreciated, a new type of fabric gear was developed. The use of bakelite resulted in a lighter gear and one that did not necessitate the use of steel shrouds. This type of gear as made by the General Electric Co., is known by the trade name Textolite, and is an addition to the Fabroil gear for different classes of service.

Construction of Fabroil

In the manufacture of Fabroil, the bales of pure cotton, forming the raw material, pass through a bale breaker and a carding machine which lays the cotton fibers flat and straight in a thin batting. This batting is then given a treatment with oil, which improves the machining properties of the completed blank and makes it practically impervious to water. From these sheets of batting, disks are cut to the required rough diameter. These disks, to the weighed amount necessary for the desired gear face, are then assembled in steel tubes, placed between steel side plates (shrouds), and compressed in a hydraulic press at a pressure of about 8 tons per square inch.

This compression is made permanent by drilling and tapping holes through the shrouds and tightly compressed cotton filler, into which are screwed through bolts, threaded for their entire length. The structure is permanent and maintains its original quality indefinitely, without any deterioration. The Fabroil rough blank produced by this process is the raw material that is machined into finished gears.

Manufacture of Textolite

The basis of Textolite is a canvas of the highest quality cotton. It is coated, but not impregnated, with a synthetic resin as a binder, and after being processed at a high degree of heat and pressure, forms, with the laminated canvas sheets, a homogeneous material in which the binder acts as an infinite number of tiny rivets, holding the textile material under compression.

For making certain gears of very small teeth, it is sometimes desirable to use a stock with a finer texture; in this case, a fine mesh muslin replaces the canvas as the basic material.

Textolite is manufactured according to the following specifications: Tensile strength, laminations edgewise, 10,000 pounds per square inch; compressive strength, laminations edgewise, 35,000 pounds per square inch; compressive strength, laminations flatwise, 40,000 pounds per square inch; bending strength, laminations flatwise, 22,000 pounds per square inch; bending strength, laminations edgewise, 22,000 pounds per square inch; modulus of elasticity in compression, 500,000 pounds per square inch; in tension, about 1,500,000 pounds per square inch; specific gravity, 1,35; weight, about 0.05 pound per cubic inch; Brinell hardness (Herman Holtz Durando model test equipment with 500-kilogram pressure on 10-millimeter steel ball for 15 seconds) on natural surface, 150; on machined surface, 135; coefficient of expansion, laminations edgewise, per inch per degree F., 0.000017 inch (about 2.5 times the expansion of medium steel) and 0.000035 inch, with laminations flatwise, that is in a direction perpendicular to laminations (about 5 times the expansion of medium steel); water and oil absorption, practically none at ordinary temperatures below 257 degrees Fahrenheit.

Machining Fabroil Gears

In drilling Fabroil gears, it is good practice to place one end of the gear blank in a four-jaw chuck and true it up. The other end is then trued up by eye, until the studs, which are threaded through the structure from end to end, run approximately in a true circle. The gear blank is then drilled, but for bores of any considerable diameter, it is necessary first to run through a smaller drill and then use a drill that will remove the stock to the reaming size. For some large gears, a boring tool is required. The floating rose-reamer is generally used, and when used, should be provided with an ample supply of oil. Allowance is made for hand-reaming after the lathe work is done.

For turning Fabroil blanks, the same tools are used as for mild steel. After boring and reaming, the blank is pressed on an arbor and turned to the required outside diameter. For this work, time is saved by using a geared-head lathe, so that changes in turning speed are easily obtained. After turning the steel shroud, the speed in turning the Fabroil face is increased to the limit of the lathe, slowing down when the other shroud is reached. About 1/32 inch is left on the diameter for a finishing cut at a speed suitable for mild steel. If an especially smooth job is desired, it is good practice to take a third cut across the face, removing a few thousandths of an inch at low speed. After the blank is turned on the outside diameter, the two shrouds

are faced, using a square-nosed tool. The shrouds should clean up with a 1/16-inch cut.

If a broach is used in cutting keyways, care must be taken to see that the drag is not too great. The best results can be obtained from a spliner, or similar machine, with a single cutter, taking a very fine feed per cut.

Cutting Teeth in Fabroil Blanks

In cutting teeth on a Fabroil blank, a rotary form cutter, a hob, or a gear shaper cutter may be used. Whichever method is employed, it is essential that the cutting edge of the tool be kept sharp. On account of the resilient nature of the filler, a cutter not having a keen edge will not produce a tooth profile of the correct shape or size. Even with a newly ground cutter, the section of the tooth profile in the filler will measure 0.001 to 0.002 inch thicker at the pitch line than when measured on the steel shroud. It is, therefore, necessary to sink the cutter about 0.003 to 0.005 inch deeper than when cutting iron or steel.

If a hobbing machine is equipped with variable-speed control, the speed may be increased across the filler section. If variable speed is not used, a feed of about 1/32 inch per revolution of the work-arbor is preferable when cutting pitches coarser than 6. For 6 pitch and finer, a feed of about 1/16 inch is used.

When teeth of 4 pitch and finer are cut with a rotary cutter, one cut should be sufficient to produce a well finished tooth profile of proper size. For an exceptionally good job, it is advisable to take two cuts. For teeth coarser than 4 pitch, two cuts, at least, are needed to produce a well finished tooth profile, the finishing cut not removing more than 1/32 inch of stock.

Feeds of approximately 2 5/8 inches per minute are good practice for teeth of 6 pitch and coarser. For teeth of finer pitches, a feed of 3 inches per minute can be used. For an especially smooth tooth profile, a slower cutting speed should be used.

If a hob is used, it should have gashes at right angles to the helix. A straight-gash hob will tend to crowd away from the true cut and produce an incorrect tooth profile. No cutting compound is needed in cutting the teeth, as the oil impregnation supplies all the necessary lubrication for the cutters.

Sometimes turnings from the steel shroud give trouble by scarring the Fabroil face. This can be prevented by having stiff wire brushes mounted above and below the hob. After cutting the teeth, it is necessary to "burr" the steel chips extending from the shrouds. These can be easily knocked off and cleaned up with a file.

Machining Textolite Gears

Gear blanks can be cut from Textolite gear board, either by band saws, barrel saws, or fly cutters. The saw kerf is a little thinner, and causes a little less loss, but the fly cutter cuts more accurate circles. Standard band saws can be used, and the higher the saw speed the better—preferably not less than 4000 feet per minute. Barrel saws are advantageous when a large number of blanks of the same diameter are to be produced.

In order to insure concentricity of bore and outside diameter, it is good practice to chuck the blank and turn one face with the lightest cut that will finish it to a plane surface. Then the blank should be turned in the chuck and the center determined either by the eye when running, or by a combination center square and prick-punch.

Grinding is the most satisfactory way of finishing the gear blanks, but they can be cut readily if the tool has a keen, hard edge, with greater clearance than that allowed in the case of metal. A high cutting speed should be used.

Bores are drilled by the same method as described in the case of Fabroil. In either case, a drill ground slightly off center, with greater clearance, will be found preferable, and it is generally necessary, when drilling thick blanks, to remove the drill occasionally to free the chips. In drilling, it is desirable either to reverse the work or to back it up with a plate stiff enough to prevent splitting the laminations when the drill comes through.

For turning tools, stellite has been found to be most satisfactory. When turning blanks of 6 to 7 inches diameter, a spindle speed of 375 to 400 revolutions per minute should be maintained, with a carriage feed of about 12 inches per minute. Under these conditions, a stellite tool will hold a keen cutting edge for a reasonable length of time.

Cutting Teeth in Textolite Gears

The same class of machines can be used for cutting the teeth as suggested for Fabroil, and in general, the rule is that the faster the cutting speed, the better the work, the usual limit being the maximum speed of the machine. The feed should be small. For tooth profiles finer than 6 pitch, a feed of 0.155 inch per revolution of the work-arbor produces a satisfactory finish with one cut. For tooth profiles coarser than 6 pitch, it is usual practice to take a roughing cut at higher feed and then a finishing cut at lower feed.

This material is highly abrasive to tools, and thus requires an especially keen edge. Stellite has been found very satisfactory for cutting Textolite. No lubrication of the cutter is required. In order to prevent turning over the laminations of the material when the cutter emerges from the work, it is necessary to back up the blank with a disk. Wood is satisfactory and also cheap. In some cases, a slight allowance in the blank width is made to allow for facing after cutting, in order to remove the burrs thrown out by the emerging cutter.

* * *

AMERICAN STANDARDS ASSOCIATION

Unanimous approval by the thirty-seven member bodies of the establishment of the American Standards Association to succeed the American Engineering Standards Committee, has been announced by William Serrill who was chairman of the Standards Committee, and now becomes president of the American Standards Association. One of the most important results of the abandonment of the committee form of organization will, according to Mr. Serrill, be a much greater degree of participation by trade associations in the direction of national industrial standardization.

Operations in Building the Marmon Car

A Few Typical Views in the Marmon Motor Car Co.'s Plant in Indianapolis, Showing Wide Application of Conveyors

THE manufacturing methods employed in many automobile plants have become so standardized that when a visitor passes through any one of the modern shops he finds that the same operations are performed in very much the same manner. There has been such a thorough interchange of information and methods of practice between production engineers in different shops, through the medium of production meetings of the engineering societies and through the technical press, that there are comparatively few wholly different operations in any one automobile plant, as far as actual machining methods are concerned.

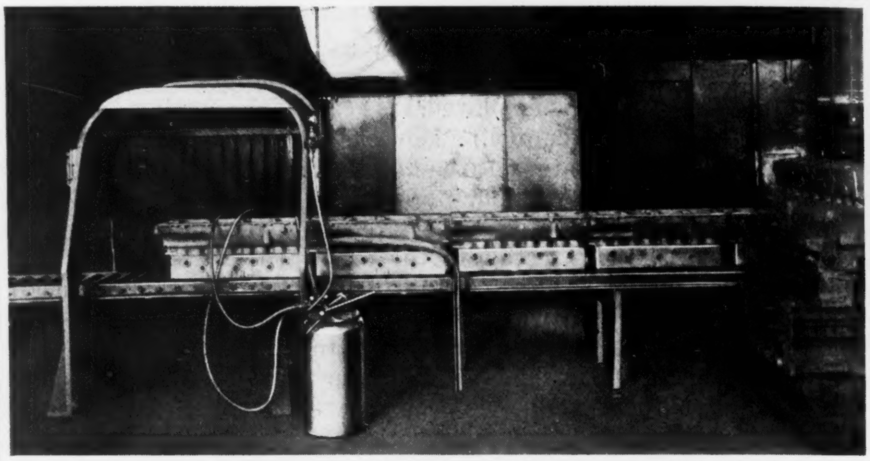


Fig. 1. The Point where the Crankcase Line Starts, Showing the Spray Booth

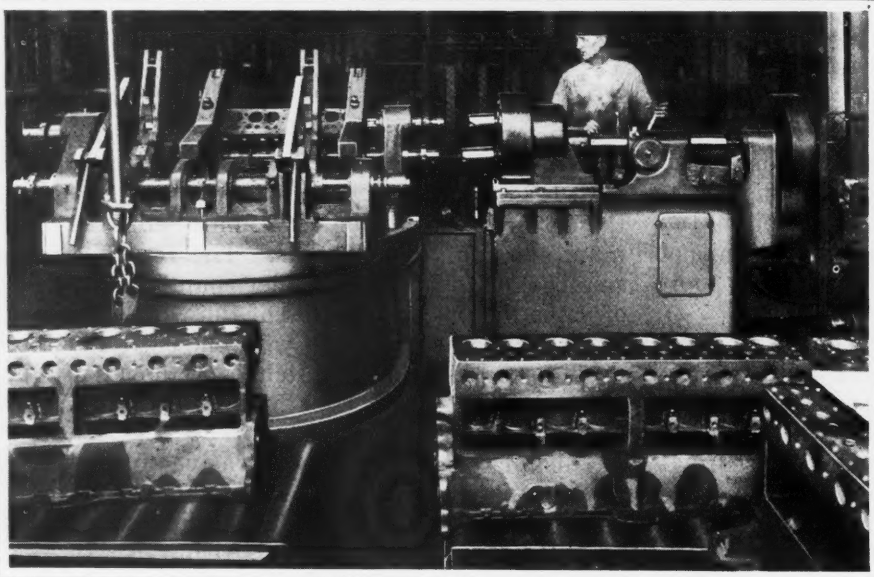


Fig. 2. Another Point on the Crankcase Conveyor Line

On the other hand, a considerable difference will be found in the methods of handling work while passing from operation to operation, and some plants are provided with far more conveniently arranged conveyor systems than others. The development of convenient materials-handling devices has meant much in the economic operation of automobile plants.

The accompanying illustrations show a few views from the plant of the Marmon Motor Car Co. in Indianapolis, Ind., particularly intended to show the conveyor equipment that is used and the methods employed for moving parts, bodies, and assembled chassis in the plant.

Fig. 1 shows the beginning of the crankcase conveyor line at the point where the shot blast and spray booths are located. Fig. 2 shows a later point in the crankcase conveyor line, immediately in front of a Rockford boring machine. Fig. 3 shows a typical sub-assembly, in this case that of the manifold and car-

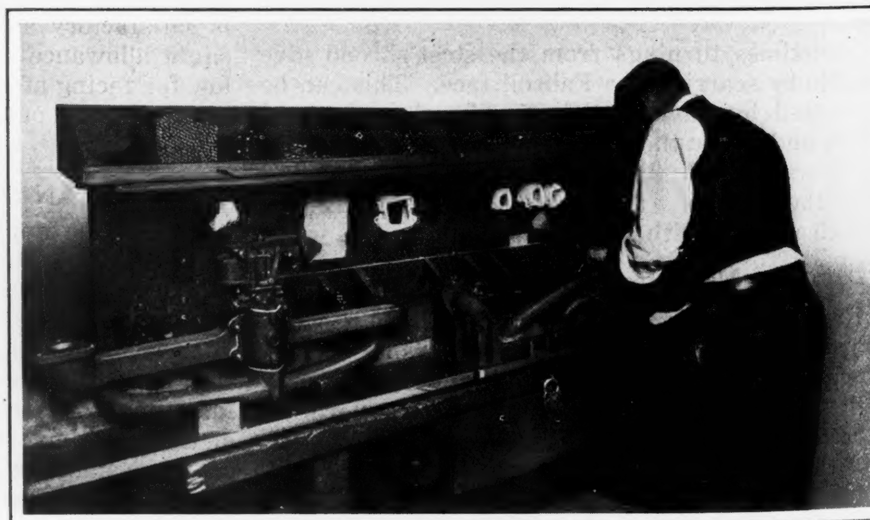


Fig. 3. A Typical Sub-assembly Ready to be Fed into the Main Engine Line

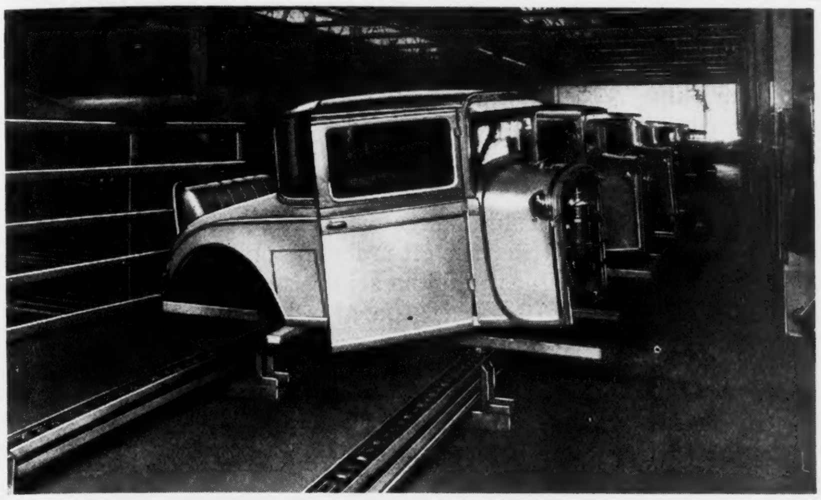


Fig. 4. Bodies on a Conveyor Line on which They are Fitted Completely Before being Mounted on the Chassis

buretor, as they are prepared ready to be fed into the main engine assembly line. The convenient arrangement of all small parts in trays and compartments at the top of the assembly bench, as well as the method of hanging other parts on pegs on the board immediately in front of the assembler, should be noted.

In Fig. 4 is shown the body conveyor, where the fitting of the bodies is completed before they are mounted on the chassis. The parts needed in the assembly work are easily accessible to the assemblers at the right.

The end of the chassis assembly line just beyond the inspection pit is shown in Fig. 5. The track is provided with a trip which operates a counter device. The chassis are now ready to be assembled to the bodies, as shown in Fig. 6 where a body is lifted, ready to be let down on the chassis. The arrangement of the lifting frame and the clamps by means of which the body may be lifted without injury to its finish should be noted.

Some of the most notable advances in equipment in automobile factories during the past year have been made in conveying equipment. There is still a great field in many plants for further developments in this respect, but it is doubtful if another industry has applied up-to-date material-handling devices and conveyor systems to as great an extent as the automobile industry. This does not mean that the automobile industry is the only one in which such a thorough application is possible, for there are many plants in other industries where there is proportionally as great a production of smaller parts, and where more adequate conveyor systems could be used advantageously than are at present applied. In many instances, for example, conveyor assembly lines can be arranged for small articles as well as for large ones; in plants where this has been done, a considerable increase in production has been made possible, and at the same time the earnings of the workers have been increased. If the work is properly planned, this can be done without rushing the operator or subjecting him to undue pressure or fatigue.

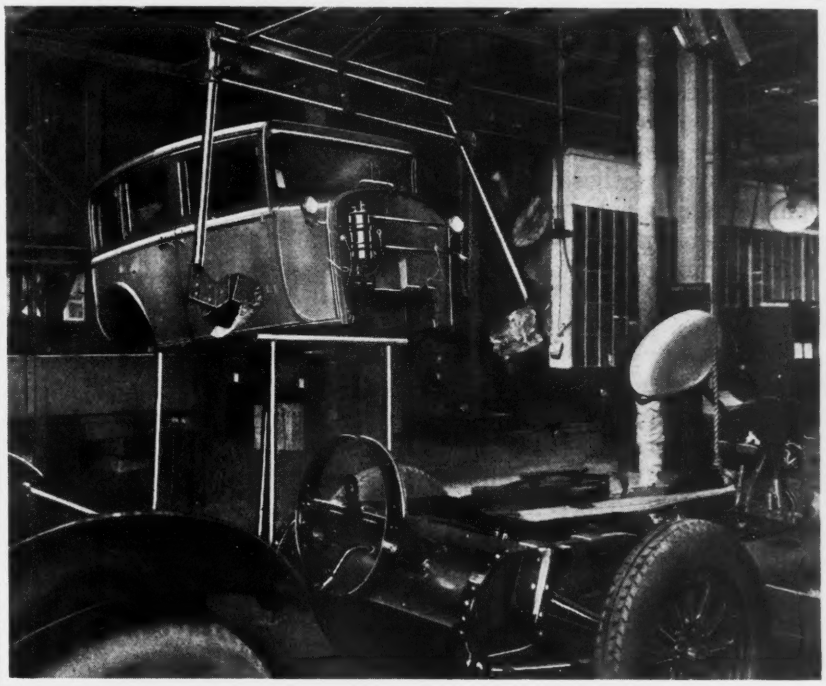


Fig. 6. Ready for the Final Step of Mounting a Body on the Chassis

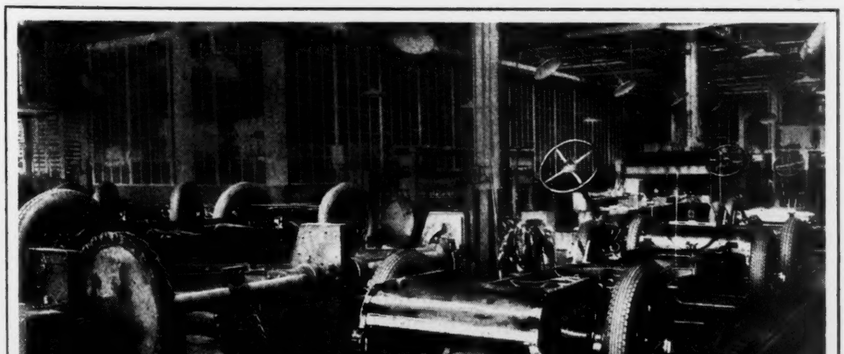


Fig. 5. The End of the Chassis Assembly Line just Beyond the Inspection Pit

OIL SEPARATORS IN SMALL SHOPS

By DONALD A. HAMPSON

In large shops, the separation of oil from chips is carried on as a matter of economy and convenience. In fact, it is the generally accepted practice. When a carload of chips accumulates every few days, a man is kept busy handling them and extracting the oil. This reclaimed oil is returned to the shop and the chips are sold in bulk as a standard by-product of industry.

The higher price received for dry chips, the reduction of fire hazards, and the more acceptable handling state of dry chips are secondary reasons for separating, the major reason being the saving of oil. When batteries of automatic machines are operated, hundreds of gallons of oil may be reclaimed hourly. In most installations of this kind, the oil is run through one or two centrifuges for cleansing and antisepticism before it is returned to the automatics.

Is Oil Separation Practical in the Small Shop?

Many executives have asked this question, having in mind the barrels of oil that cling to the chips sent to the dump each day from the drilling machines, turret lathes, and gear cutters. Because separators are not "pushed" by salesmen, as are machine tools, there seems to be a general lack of information about them and their success in the small shop.

Separators for oily chips differ very little from the familiar "extractors" used in laundries for drying clothes. The chip basket rides at the upper end of a vertical shaft which is driven at a sufficiently high speed to cause the oil to leave the chips and travel toward the periphery, where it is thrown off by centrifugal force.

Operation of Separator

Chips are placed in the inner basket, which is of sheet metal and has sides that flare at approximately 30 degrees from the vertical. A cover is clamped over the basket and the machine started. At first, the assembly wobbles badly, but it soon rights itself, passes the critical speed, and settles down to quiet running. Oil is thrown outward from the chips to the sloping sides, up which it passes, to escape finally through spaces under the cover. There are no perforations in the baskets of oil separators that can become clogged with chips. The oil is caught inside the cast-iron case of the machine itself, down the sides of which it trickles into a settling groove, from which it is piped outside.

Most of the oil is thrown out in the first few seconds of running at full speed. General instructions call for running as long as half an hour, but experience shows that five minutes is the average economic limit. A longer period does not show returns that compensate for the power used and for the wear of the machine.

Capacity of Oil Separators

Separators with baskets holding from 3/4 to 1 bushel of chips are suited for use in small shops. Such baskets are about 1 foot deep and 20 inches in diameter at the top. The baskets run between 1000 and 1200 revolutions per minute, and have pulleys for belts 3 inches in width. If motor-driven, from 2 to 3 horsepower must be provided, depending upon how the drive is arranged.

The experience of one small shop which purchased a separator may be of value to others. Three screw machines of small size were run a total of 150 machine-days per year in this shop, and it was to extract the oil from the chips produced by these machines that the separator was installed at a cost of $275. The separator held 0.85 bushel of chips when filled within an inch of the top. From two to three such loads accumulated in a day's run, and from each of these loads, an average of 7 1/2 quarts of oil, costing 60 cents per gallon, was extracted.

Once this machine was installed, other sources of oily chips were discovered about the shop. The powder-fine chips from a spline miller were separated from their imprisoned oil. These chips were so fine that they would mat together if loaded alone, but were broken up successfully when dumped in with a load of turnings. Chips from the milling and drilling machines also increased the volume of oil saved. Needless to say, this separator almost paid for itself in the first year.

There is no market for small quantities of loose steel chips. If there is adjacent low land, the chips are used for filling in; if not, they must be carted away. In either case, the oil attached to the chips constitutes a fire hazard, even though it is oil of low volatility. Chips that have passed through the separator are so free from oil that they may be handled with white gloves without showing stain.

* * *

MEASURING ECCENTRIC THROW WITH A DIAL INDICATOR

By F. EDWARDS

The writer has found a dial indicator to be the quickest and most accurate method of measuring the "throw" when turning or boring small eccentrics, in cases where the throw does not exceed the range of the indicator. As the dial indicators have a movement of 0.250 inch, any eccentric having a throw of not more than this amount can be set in the chuck for boring or placed on centers for turning, by noting the difference between the high and low readings on the dial.

The writer was recently assigned the task of boring a 5/8-inch hole in a collar, so that the collar would have a throw of 0.092 inch when forced on its shaft. This was readily accomplished by using a dial indicator for locating the work in the chuck. By adjusting the independent jaws of the chuck, the work was thrown off center an amount sufficient to make the difference between the high and low readings equal 0.092 inch as required.

* * *

MICARTA AIRPLANE PROPELLERS

In connection with the article "Making Micarta Airplane Propellers," published in February MACHINERY, page 409, it is of interest to note that the practice described is that employed by the Westinghouse Electric & Mfg. Co. in making airplane propellers from Micarta. The photographs were all obtained at the plant of that company.

Letters on Practical Subjects

PIPE CLAMP FOR MAKING WELDED JOINTS

In welding the joints of pipe such as is used in creosoting plants, it is necessary to align the sections of pipe to be welded and to hold them securely in position while "tacking" or welding the joint in spots, as indicated at *W* in the accompanying illustration. The clamp for holding the pipes was designed by the writer and built in the plant of the Metal Products Mfg Co., Seattle, Wash. The one shown is for 3-inch pipe, but the design can be adapted to other sizes.

The clamp consists essentially of four steel rods *A*, held together by, and pivoted in, the links *B*, and clamped by hooks *E*, which are actuated by the eccentric clamp handles *D*. The handles *D* pivot on pins *G* and are connected to one of the rods *A* by the adjustable links *H*.

In using the clamp, one end is clamped to one piece of pipe, after which the other pipe is brought into the welding position and clamped in place. The pipe sections are thus accurately aligned and securely held in place while welding the ends together at spots between the rods.

The clamp is then released by moving the handles *D* to the open position indicated by the dotted lines. The hooks *E* can now be lifted from the rods and the clamp removed. The weld is then continued around the pipe until a tight joint is formed.

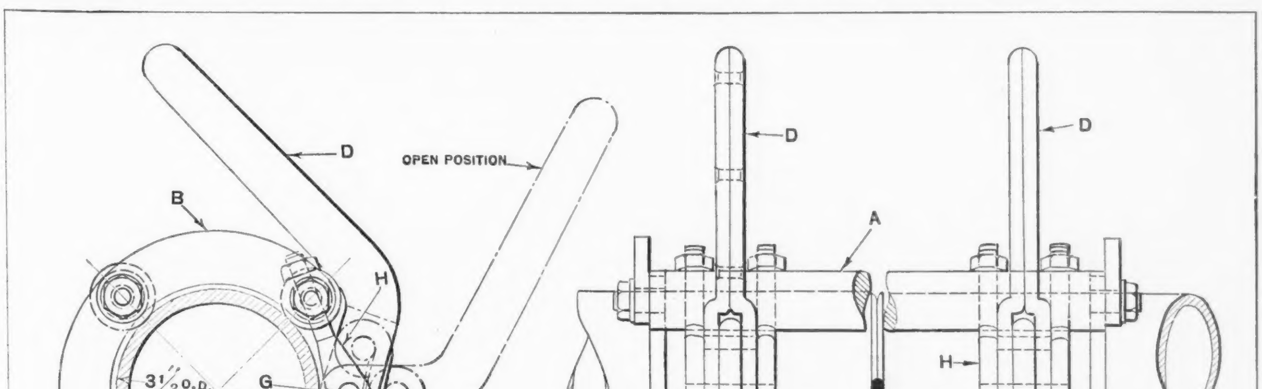
The welding clamp can be easily constructed and will give good service. It can be quickly attached or removed from the pipe and holds the sections securely together while making the spot welds.

Seattle, Wash. CARL E. SCHINMAN

HAND-FED RADIUS-TURNING TOOLS FOR TURRET LATHE

The special turret lathe set-up shown in the accompanying illustration is used for machining the large brass casting indicated by heavy dot-and-dash lines. The casting forms part of a water-measuring device, and must be held to close limits of accuracy. It is first chucked in the usual way for finishing the back face and back shoulder at *Z*. These finished surfaces are then used for locating the work in the chuck *A*, ready for the operations performed by the radius turning tools and the special facing tools.

Three holes are drilled and tapped in the casting to receive the clamping bolts *B*. The large size of



Clamp Used in Making Pipe Joint Welds

the casting and the unusual operations specified made the special set-up necessary. The operations consist of finishing the faces W, the angular face U, the ball seat V, and the sweep or large radius T.

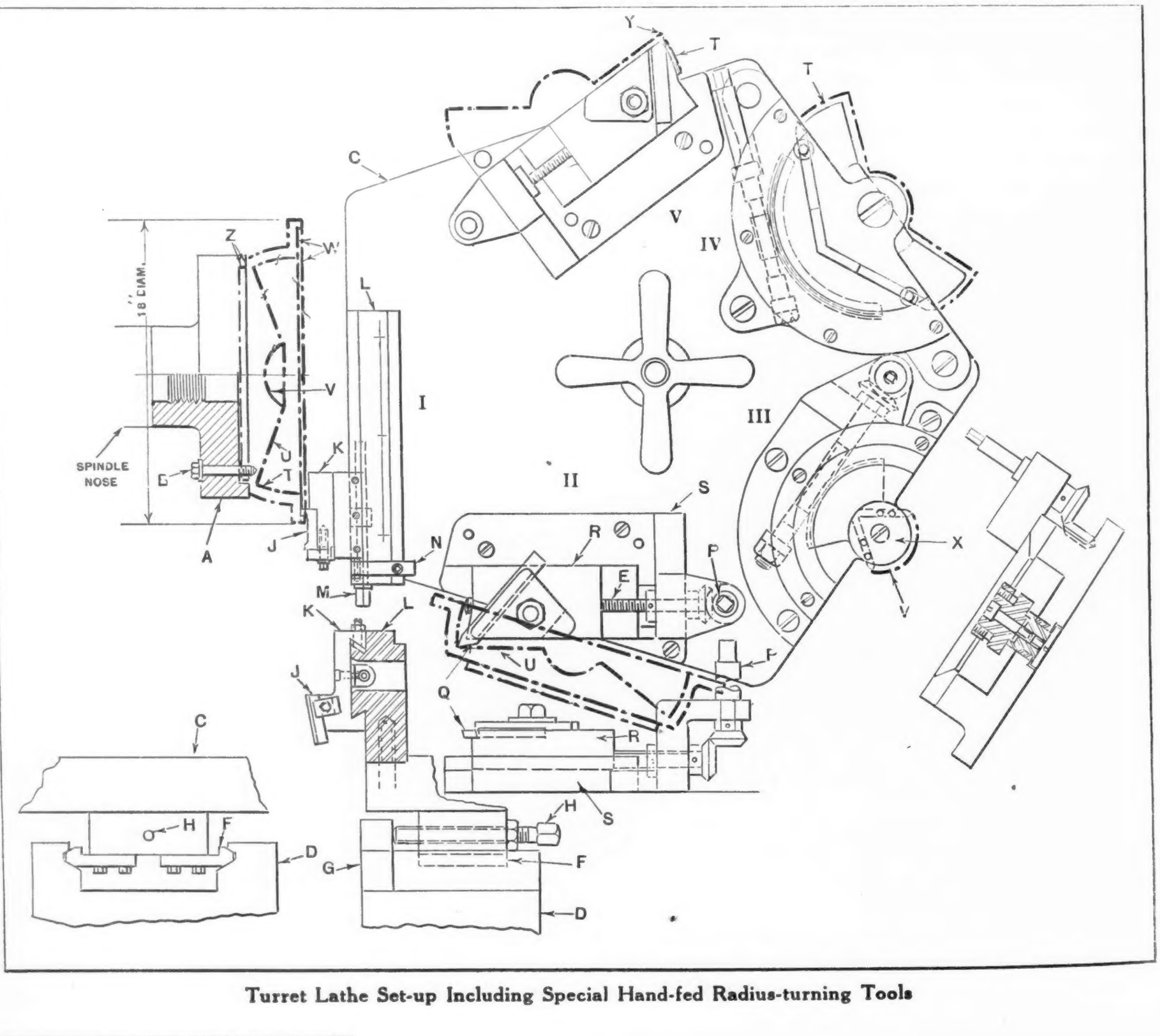
An old turret lathe was utilized for the job, the turret being removed and replaced by the five-sided cast-iron plate C. Upon this plate were mounted, in equally spaced positions, the five special tools used for performing the machining operations. The old indexing mechanism in the turret-slide (not shown in the illustration) was altered to give five positions instead of six as in the original mechanism.

To insure accuracy and rigidity during the machining operations, a block D was clamped to the bed of the lathe directly in front of the chuck, allowing clearance for the work and the tools. In the top of this block was machined a dovetail slot. Underneath each station on the index-plate C were fastened dovetail slides F which slide in the block D as the turret plate C is advanced for the cut. A hardened block G was fastened to the back of the dovetail block D, and the adjustable stop-screws H in the slides F were set to strike this block at the correct position for the various cuts. The turret-slide is clamped in the positions located by the stop-screws, thus insuring accuracy and rigidity.

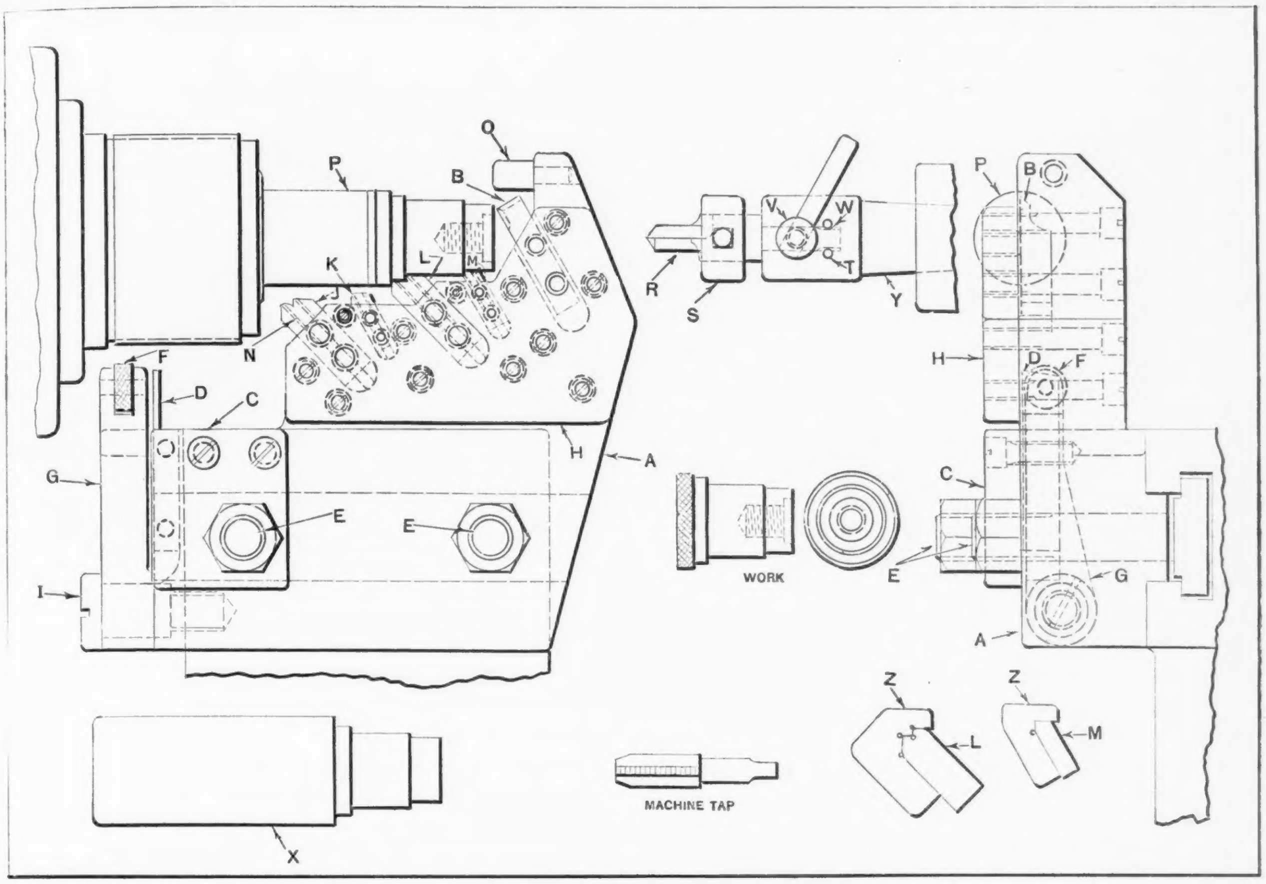
The first operation consists of finishing the outer and inner faces W, the inner face being machined to the required recess diameter. This is done by the tool J, which is clamped in an angular slot in the tool-block K. Tool-block K is provided with a slot which is a sliding fit on the dovetail machined on plate L, the latter being fastened to the turret plate C. Tool-block K is fed in or out by a screw M operated by a handle, not shown in the illustration. The block K is fed against the adjustable stop N on plate L, thus giving the required accuracy for the inside diameter of the recess formed by machining the inner face W.

After this cut, the turret-slide is moved back, the turret plate C indexed to position II, and clamped by the handle P, after which the turret is brought in against stop G and clamped in place. The angular face U is then roughed out by the tool bit Q, clamped in slide R, which is fitted in a dovetail in the base S. The slide R is actuated by the screw E, which is turned by means of a handle on the vertical shaft P. This arrangement keeps the operator's hand away from the danger zone. As will be noted, the base S of this tool is fastened on the index-plate C in such a manner as to give the required angle to the face U.

The ball seat V is finished by the tool shown in position III. The tool bits are clamped in the stem X and turn with this stem, which is part of a worm-gear sector. This sector is actuated by a worm, operated through bevel gears and a vertical shaft provided with a handle which also keeps the operator's hand away from the revolving work. One



Turret Lathe Set-up Including Special Hand-fed Radius-turning Tools



Production Tool Equipment for Engine Lathe

of the tool bits in post X roughs out the seat, and the other does the finishing, two cuts being necessary to complete the seat.

In the fourth position is shown the tool for finishing the radius T. This tool is very much like the one used in the third position. The radius T, however, is very much larger than that of the spherical seat V. One of the tool bits is used for roughing and the other for finishing.

In position V is shown the tool for finishing the angular face roughed out at position II. This tool gives a sharp corner at Y, as called for by the specifications. It will be noted that all the tools are fed by hand. The main requirement is accuracy and finish. A high production rate, however, is not required.

New York City B. J. STERN

HIGH-PRODUCTION LATHE TOOL

The tool shown in the accompanying illustration should be of especial interest to superintendents of small and medium-sized job shops, where a turret lathe may not be available. The writer's problem was to develop a tool for an engine lathe for completing all turning operations on the piece, as well as knurling, drilling, counterboring, tapping, and cutting off without resetting the tool.

The piece to be machined is a cold-rolled steel bearing-knob, which is a component part of a bread-wrapping machine. The tool-holder A is fitted to the compound rest of the lathe, and is held rigidly to this rest by the two bolts E. The rough-turning tools J and K, as well as the finishing tools L and M, may be moved in or out in the tool-holder A by turning the adjusting screws N in the tool bits themselves. The spotting tool B requires no fine adjustment, and hence is not provided with an adjusting screw. In the plate H, fastened to the tool-holder, are hollow-head set-screws for securely fastening the tools, when they are once set. The cutting-off tool D is fastened into the holder by set-screws in the small plate C, which, in turn, is secured by the two fillister screws and one of the bolts E.

The knurling-tool holder G is interesting, inasmuch as it is designed so that it can be swung backward out of the way when the tool D is cutting off. The holder swings on shoulder-screw I, and when it is in the knurling position, it rests on the protruding ledge H of the tool-holder A. The knurl F is located below the center line of the work to prevent the knurling tool from rising during the knurling operation. Pin O is a drive fit in tool-holder A, and serves as a stop for the stock. The tool B is for spotting the end of the bar to insure a true start for the drill R.

The combination drill and counterbore R is a sliding fit in the taper-shank holder Y. It is prevented from turning by the pins T bearing against the two flats W, and is secured by the handle-mounted set-screw V. The holder Y is held rigidly in the tailstock spindle.

In operation, the spring collet holding the bar stock is released, and the bar is carried out against the stop-pin O. The position of this stop-pin in relation to the shoulders on the finished work is governed by a set of rod-stops attached to the ways of the lathe near the headstock. These stops are not illustrated, inasmuch as they are standard equipment on certain turret types of engine lathes, and can be procured at small cost.

The spring collet is now closed, the carriage is moved back, and the cross-slide is fed in to a predetermined graduation mark on the cross-feed dial, for rough-turning with tools J and K. The carriage is power-fed until near the end of the cut, and then it is hand-fed up to the standard stops already mentioned.

The same procedure is followed for finish-turning with the tools L and M. The end of the bar is now spotted with tool B, followed by the combination tap-drill and counterbore R, the collar-stop S governing the depth. The drill R is now quickly removed and replaced by the machine tap, which finish-taps the piece.

The carriage is next moved back, and the work is knurled. The knurling-tool holder is then swung backward out of the way to allow the cutting-off tool D to enter the work. The cutting-off tool is located in the same manner as the stop O and the turning tools. During the cutting-off operation, the sharp corners of the knurled diameter are removed with a smooth file. This completes the work with the exception of disk-grinding the large end.

The bar X is used for setting the tools and stops. It is trued up in the lathe, and the tools are set to correspond to the small end, which is a replica of the piece itself. The turning tools are accurately ground to fit the profiles of their respective gages Z.

Fairfield, Conn. J. E. FENNO

MOTOR DRIVES ON COLUMN BRACKETS

Considerable floor space may be saved by mounting motors for driving light machinery, such as grinders, small milling machines, and drill presses, on column brackets, as shown in Figs. 1 and 2. Installations of this type eliminate the necessity for providing extension brackets on the machines or locating motors on the floor.

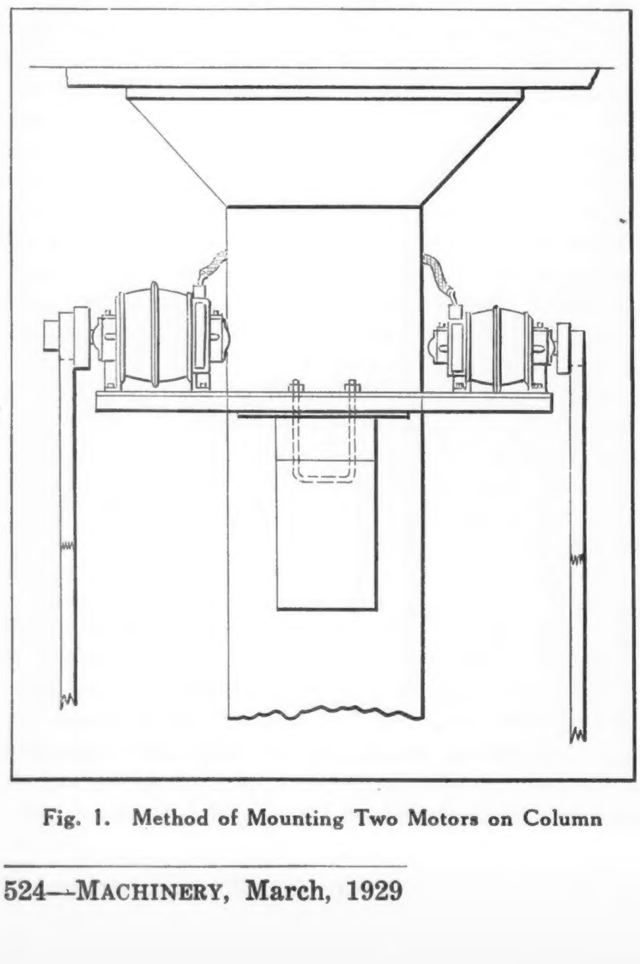


Fig. 1. Method of Mounting Two Motors on Column

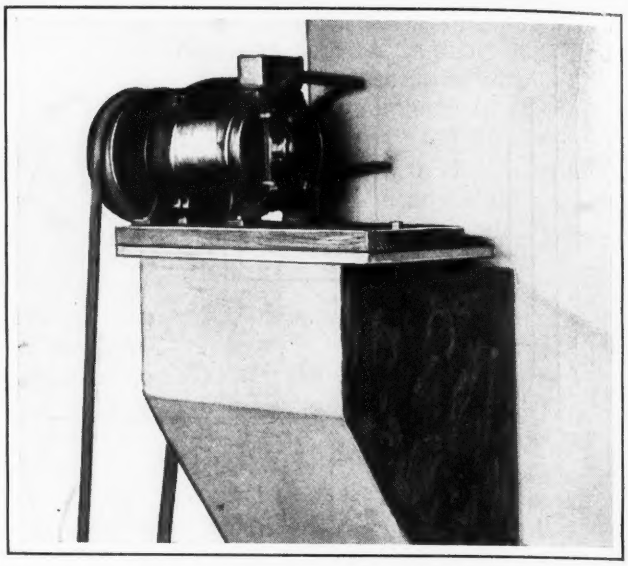


Fig. 2. Motor Mounted on Column

Occasionally two machine tools are placed adjacent to a column, and in such cases, a reinforced wooden support is mounted across the column bracket and the motors are located as in Fig. 1. The mounting of motors on columns as illustrated not only saves floor space, but also prolongs the life of the motors, as they are raised above the flying emery dust and chips. When variations in speed are required, cone pulleys can be mounted on the motor shafts to correspond with the machine pulleys. U. J.

CORROSION FROM CUTTING OILS

The interesting article, "Test for Corrosiveness of Soluble Cutting Oils," in October MACHINERY, page 124, fails to take into consideration one after effect of using cutting oil which is often erroneously attributed to the cutting oil. That is, the soluble cutting solution is not necessarily corrosive in itself, but through its use the slight film of oil which normally adheres to and protects any machined and polished surface may be removed, thus permitting the oxygen and corrosive gases in the air to attack the bare metal.

In one plant on the Atlantic seaboard where the writer was engaged in the installation of a battery of new machines, the superintendent blamed the cutting oil for the poor finish on machined parts, although records showed that five different formulas had been tried during the year without bettering results. Having previously recommended the identical oil to another plant and knowing that it gave complete satisfaction there, the writer tried a simple experiment to discover the true corrosive agent.

Strips of the polished steel were warmed slightly to give better adhesion, and coated with commercial paraffin. Then, with a bone scraper, which would not mar the surface of the steel, the writer formed channels, 1/4 inch wide, cutting entirely through the paraffin so that the metal was exposed. The cutting solution was next flowed on the plates or strips. Half of the strips were hung up in the air to dry while the other half, still moistened with the solution, were sealed within air-tight Mason jars.

At the end of ten days, the samples were compared, and, without exception, those exposed to atmospheric conditions were cloudy and blotched, while those that were in the jars were as bright as when put away. Using the paraffin to protect most of each strip, gave complete control of the area subjected to corrosion, and when the paraffin was removed by warming the strip, an accurate comparison of the "before and after" appearance of the same piece of metal was readily made.

To complete the investigation, other strips of stock were covered with paraffin and the 1/4-inch channels cut through the paraffin as before, but instead of using the cutting oil, various non-corrosive industrial cleansers were employed to remove the slight oil film. These pieces were then exposed to the air. In all instances, except where the cleanser could be proved to have left a protecting film of its own, the exposed material showed the same unsatisfactory surface for which the cutting solution had been blamed.

In this particular plant, the corrosion problem was solved by storing the finished material overnight in a specially fitted stock-room in which there was a current of warm air circulating over an oil atomizer. This oil-treated air was circulated through the racks containing the finished product. There was not enough oil deposited to be noticeable, but it proved ample to check corrosion and reduce rejections on this count to a negligible quantity.

Savannah, Ga. ELTON STERRETT

COMPENSATING JAWS FOR HOLDING CAST-STEEL WHEEL HUBS

A chuck equipped with a pilot for locating the work and with jaws that compensate for variations in the rough outer surfaces is shown in Figs. 2, 3,

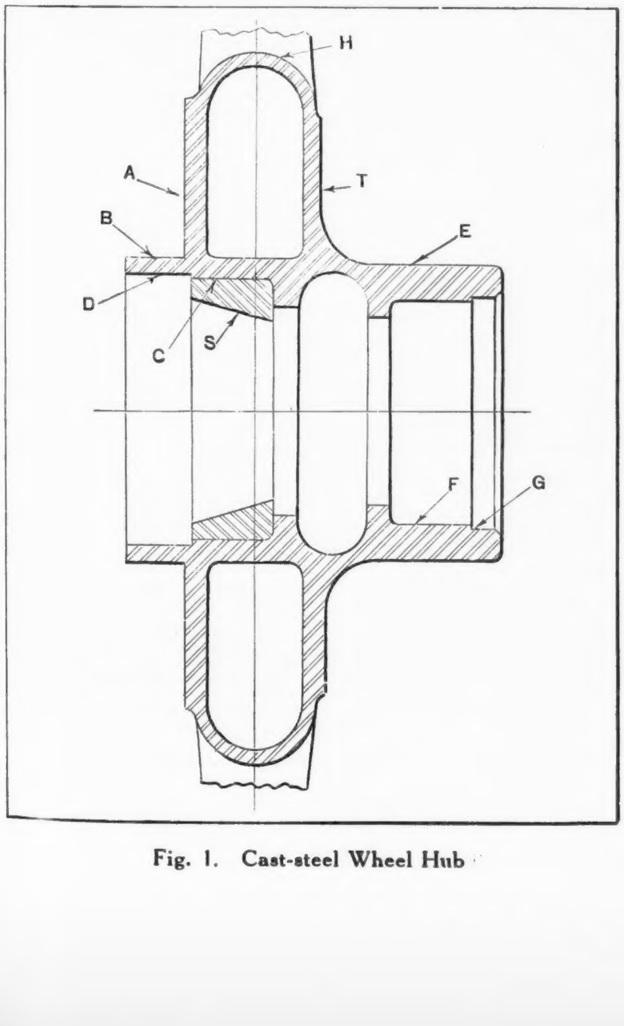


Fig. 1. Cast-steel Wheel Hub

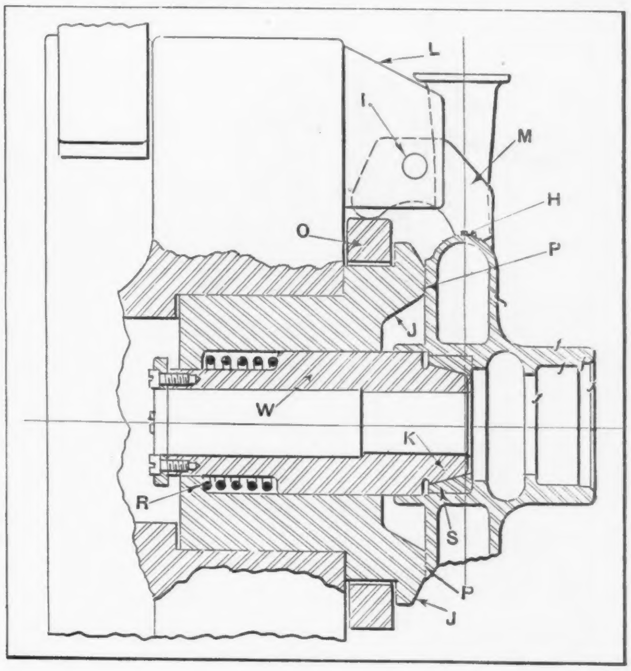


Fig. 2. Cross-section of Compensating Jaw Chuck and Work

and 4. Although the illustrations show the jaws applied to a Foster-Barker chuck, the same design could be adapted to scroll type chucks. In Fig. 1 is shown the cast-steel wheel hub for which the compensating jaws were designed. This hub is finished on surfaces *A*, *B*, *C*, and *D* at the first chucking. The interior of the hub at *C* is bored and reamed to receive the outer shell *S* of a roller bearing, which is pressed into place before chucking the work for finishing the surfaces *T*, *E*, *F*, and *G*.

The three surfaces *E*, *F*, and *G* must be true with the surfaces *A*, *B*, *C* and *D* within close limits. When finishing the surfaces *E*, *F* and *G*, it is desirable that the work be gripped on the rough surface *H* of the casting, as shown in Fig. 4. It is obvious that this surface cannot be utilized for aligning or centering the work from the previously finished bores, when using a chuck having jaws that open and close simultaneously at a uniform rate, unless some means of compensating for variation in the castings is provided.

The principle on which the compensating jaws operate will be understood by reference to Figs. 2 and 3. At *J* is a hardened and ground steel sleeve pressed into the body of the chuck. The hardened and ground steel pilot sleeve *W* is a sliding fit in sleeve *J*. The end *K* of sleeve *W* is ground to fit the taper of the roller bearing shell *S*, which is pressed into the work immediately after the previous machining operations. The tapered end *K* of sleeve *W*, which serves as a pilot, is held tightly in place in the taper bearing by means of the spring *R*.

Each jaw *L* is fitted with a rocker block *M*, which grips the work. The rocker blocks are carried in slots milled in the chuck jaws, and are pivoted on pins *N*. The rear end of each rocker block rests on the floating ring *O*.

After the work is placed over the pilot *K*, the jaws are closed against the rough casting, as indicated at *H*, Fig. 4. The jaw that strikes the cast-

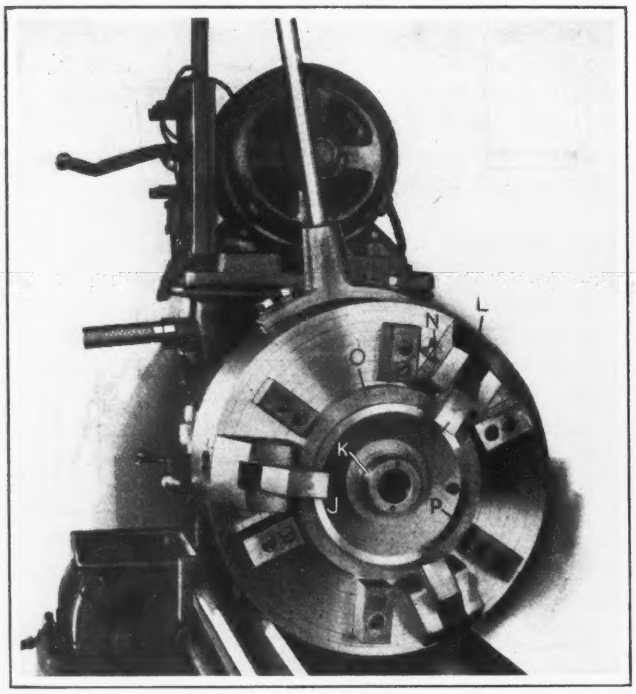


Fig. 3. Chuck Equipped with Compensating Jaws

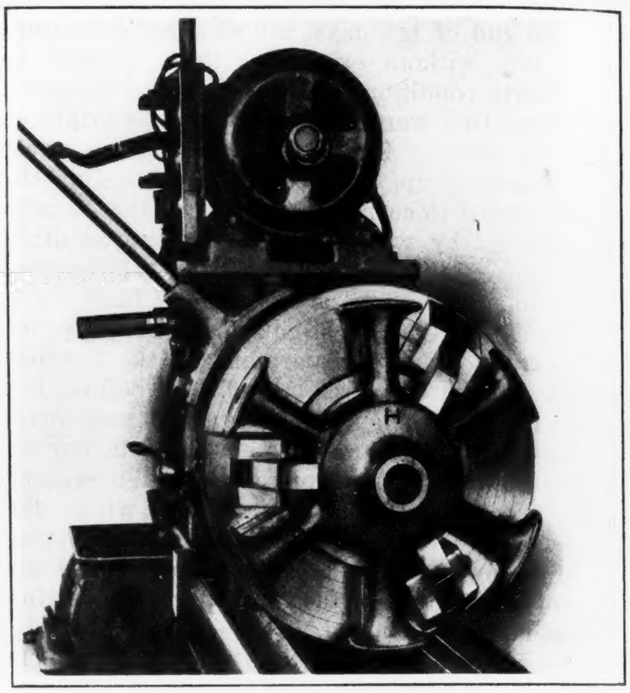


Fig. 4. Wheel Hub Held in Chuck Shown in Fig. 3

ing first moves the ring *O* until all jaws are in contact with the work. The jaws then swing toward the face of the chuck, clamping the work securely against the face *P* of sleeve *J*. A chuck equipped as described is not damaged in any way and can still be used for other work, which is not the case when a scroll type chuck is taken apart and the scroll reground to give a floating action.

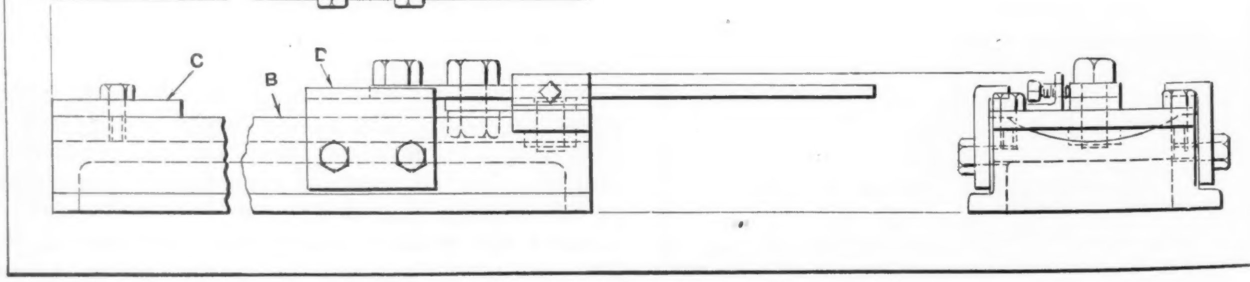
Elkhart, Ind. I. F. YEOMAN

TOGGLE RELEASE FOR FAN BLADE FORMING DIE

Fan blades like the one shown at *A* in the accompanying illustration are formed from pieces of 16-gage sheet steel sheared to the proper width and length. The pieces are curved to the correct radius and the flange bent up at the ends in a forming die like the one shown in the illustration. As the blade is rather long in proportion to its width, it is quite springy. This characteristic makes it difficult to remove the formed blade from the ordinary type of die. To overcome this difficulty, the forming die was fitted with a sliding end or block *D* which can be withdrawn to release the work.

The die consists of a cast base *B* having a curved upper face which forms the curved part of the work when the punch member descends on the blank. The end block *C* is secured in a fixed position on the base, while the block *D* slides on the base but can be held in position during the forming operation by the toggle lever arrangement operated by handle *E*. The short link *F* on the under side of lever *E* pivots about the pin *O*, so that the sliding end block is moved in or out when the lever is swung about its pivot bolt *G*. When the three pins *G*, *H*, and *O* are in line, as shown in the illustration, the die is locked ready for the forming operation. As soon as the lever is moved to the right, the sliding block moves back and releases the formed piece.

St. Louis, Mo. P. H. WHITE

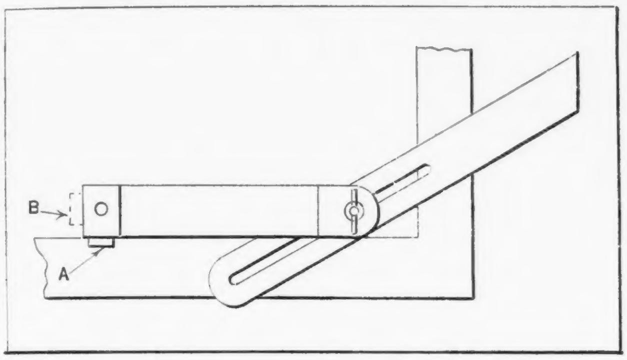


Fan Blade Forming Die Provided with Releasing End Block

Shop and Drafting-room Kinks

AUXILIARY ALIGNING BLADE FOR BEVEL

The small auxiliary blade shown at *A* in the accompanying illustration is applied to the regular machinist's bevel to insure accurate alignment when using the bevel in the position indicated. The blade is the same thickness as the main blade, and can be folded back so that it occupies the position indicated by the dotted lines at *B*, when not in use. The writer believes that manufacturers of small tools would find it to their advantage to equip bevels with auxiliary blades such as described.

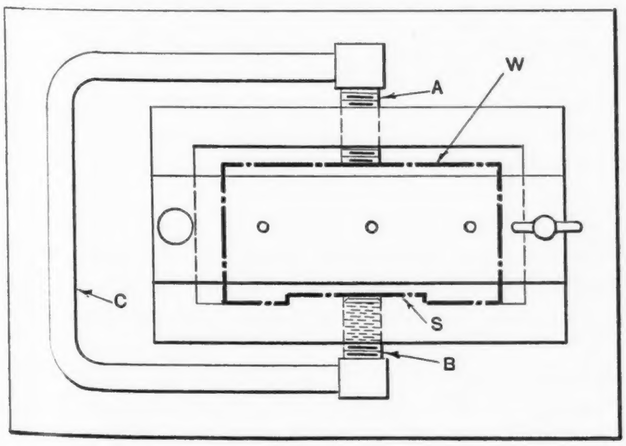


Machinist's Bevel Equipped with Auxiliary Aligning Blade

HERBERT A. FREEMAN
Willimantic, Conn.

JIG WITH COMBINATION CLAMP AND WORK EXTRACTOR

The box type jig shown in the accompanying illustration is commonly used for drilling milled work, such as indicated by the dot-and-dash lines at *W*. Whenever the work has a milled depression or slot, as at *S*, it is located in the jig by means of a pad that fits the slot. As the pad is generally made a good fit in the slot, the work often sticks and must be forced off by means of a screwdriver or a screw. In order to make this operation automatic, the clamping screw *A* of the jig shown was joined by a bent-steel handle *C* to the screw *B* which serves to force the work from the locating pad. This permits the work to be released and forced off the pad when handle *C* is swung from the left- to the right-hand position.



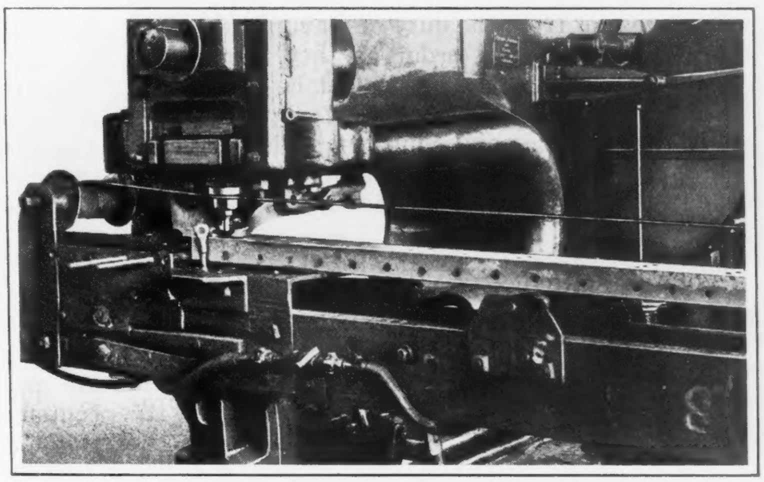
Box Jig Equipped with Combination Clamp and Work Extractor

The pitch of the screws is such that half a turn of the handle *C* is sufficient to clamp the work in place or force it off the pad. The distance between the screws is made slightly greater than the thickness of the work. This enables the work to be easily placed in the jig or removed.

Hamilton, Ont., Canada A. KENDALL

PRESS EQUIPPED FOR PUNCHING HOLES IN CHANNEL WEBS

An efficient labor-saving arrangement for punching holes in the webs of channels is shown in the accompanying illustration. The heavy work of moving the channel forward is done by means of the cable and drum shown at the left. The channel is held in a rigid position by means of bars also shown at the left.



Punch Press Equipped with Cable and Drum for Moving Channel Iron

San Francisco, Calif. C. W. GEIGER

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MILLING CUTTER STANDARDIZATION

Copies of the proposed standard nomenclature, standard keys and keyways for milling cutters, and standard profile and formed milling cutters, that have been prepared by the sub-committee on the Standardization of Milling Cutters, jointly sponsored by the American Society of Mechanical Engineers, the Society of Automotive Engineers, and the National Machine Tool Builders' Association, are now available for criticism and comment. Copies may be obtained by addressing the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

Questions and Answers

REMOVAL OF MACHINERY FROM LEASED PREMISES

T. M.—A foundry location was leased for a term of years, and the lessee agreed to surrender the premises in as good order as they were when first leased. The lessee made a few additions to the buildings, and installed some heavy equipment which was, of necessity, securely attached to the premises. At the expiration of the lease, the lessee removed the additions he had installed, as well as the heavy equipment, and in doing so left the premises in such condition that they could not be used for foundry purposes until extensive repairs had been made. This condition was not caused through any carelessness of the lessee, but was the natural result of the removal of the additions and heavy equipment. Is the lessee liable for damages?

Answered by Leslie Childs, Attorney at Law, San Diego, Calif.

From the question, it is assumed that the lessee had the right to remove the additions and equipment he had installed. But, even so, this would not relieve him from the duty of leaving the premises in the same good order as they were when taken over. Under this agreement he was bound to restore the premises, and the fact that he removed the additions and equipment with due care will not relieve him from liability for damages made in the removal. (244 Pac. 273.)

BRASS FORGING AND HOT PRESSING

T. H.—In different articles on the general subject of forging brass parts, I have seen references to "brass forging," "hot-pressing," and also to "die-pressed castings." Do these terms relate to processes which are similar?

A.—Parts formed to the required shape in dies and made from forgeable brass rod, to replace small castings and screw machine parts, may be produced either by a forging or a hot-pressing process. The term "brass forging" is applied more particularly when dies are used in conjunction with some type of power hammer, such, for example, as a drop-hammer or a steam hammer. The heated brass rod is formed in dies by a succession of blows, so that the operation is actually one of forging.

Hot-pressing, according to approved usage of the term, relates more specifically to the use of some form of press in conjunction with suitable dies for forming heated brass slugs by a single press stroke. Thus the metal is forced to fill the die cavity by a powerful squeezing or pressing action rather than by a succession of blows. Parts produced by hot-pressing have also been called "die-pressed castings," but the term "casting," as applied to this process, is somewhat misleading.

The percussion press, which has a screw-operated slide and a friction drive, is particularly adapted to the hot-pressing of brass and steel parts. Both single- and double-acting crank presses and hydraulic presses have been used for hot-pressing.

CONTRACTS FOR EQUIPMENT SIGNED BUT NOT READ

M. L. C.—A few weeks ago, a salesman solicited our business on certain power devices. We did not place an order at his first visit, but when he called again, I told him we would buy one of his devices. He filled in an order blank and I signed it without reading it, believing it was an order for one machine. Later, we received shipment of two of the machines and the firm demands that we accept and pay for both, stating that the salesman says we ordered two of the devices according to the written orders. Is there any way that we can avoid paying for the extra device which we do not need?

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

Of course, if you can prove that the salesman fraudulently made the order call for two power devices instead of one, as you instructed him to do, you may avoid liability, provided the manufacturer did not make the extra device to order. For example, in the quite recently decided case of 135 S. E. 450, it was disclosed that a purchaser failed to read the contract that he signed. During the litigation that later developed, testimony was introduced to show that the obligations which he had assumed when signing the contract were much greater than he expected. He also testified that he had informed the salesman that he was "too busy at the time to read over the contract" but would rely on the statements made by the agent and sign it, since he had to wait on his customers and could not possibly read the written instrument. The purchaser refused to accept and pay for the goods on the grounds that the salesman had misstated the contents of the order. It is interesting to note that this Court held the buyer liable, and said:

"The duty to read an instrument, or to have it read, before signing it is a positive one, and the failure to do so, in the absence of any mistake, fraud, or oppression, is a circumstance against which no relief may be had, either at law or in equity . . . There are none so blind as those who have eyes and will not see; none so deaf as those who have ears and will not hear."

Therefore, it is quite apparent that it is the legal duty of a purchaser to read all contracts before signing them, and where the salesman testifies that he did no fraudulent act, and it cannot be proved that he did, the buyer is liable.

* * *

During the first nine months of 1928 Great Britain exported machine tools to a value of approximately $6,225,000 and imported machine tools to a value of slightly over $5,000,000. The principal machinery exports of Great Britain are textile machinery. Of this class of equipment over $40,000,000 worth was exported in the first nine months of the past year. Textile machinery to a value of about $7,000,000 was imported.

A Puzzling Experience with a Step Bearing

Difficulties Experienced in Replacing a Step Bearing of a Foreign Built Machine and How They Were Overcome

By JOHN J. MARSHALL

THE replacing of a step bearing on one of two centrifugal drying machines of German make purchased in 1908 brought to light some interesting facts regarding the operation and design of bearings of the step type. The machines referred to are of the overhead basket type, arranged for quarter-turn belt drives and designed for a full load speed of 650 revolutions per minute. The approximate weight of the basket and load is 1150 pounds. The shaft on which the basket is mounted is supported by two vertical bearings and a step thrust bearing. These bearings, in turn, are mounted as a unit in the yoke frame *A*, Fig. 1. The long upper bearing is lubricated with grease, and the lower bearing and the step bearing are run in an oil bath, as indicated in Fig. 2.

The lower end of the frame *A*, Fig. 1, has a semi-spherical base which fits into a grease-lubricated cup in the base of the main frame of the machine. The upper portion of the bearing frame is supported by six evenly spaced, adjustable horizontal rods *B*, 3/4 inch in diameter, which pass through the side of the main frame. Each rod is provided with a soft rubber buffer *C* to absorb vibration or shock resulting from any slightly unbalanced condition of the load.

To prevent the metallic product from being carried away with the wash water, the interior of the basket is fitted with a lining of closely woven filter cloth, securely held in place by wooden pegs pushed into the rim. These filter cloths must be accurately fitted to the interior of the basket in order to prevent a sudden shifting of the load while the machine is in operation. During 1918, while the writer was on a vacation, trouble developed in one of the machines, which caused excessive vibration at all speeds. The foreman machinist diagnosed the trouble as a broken step bearing, and dismantled the machine.

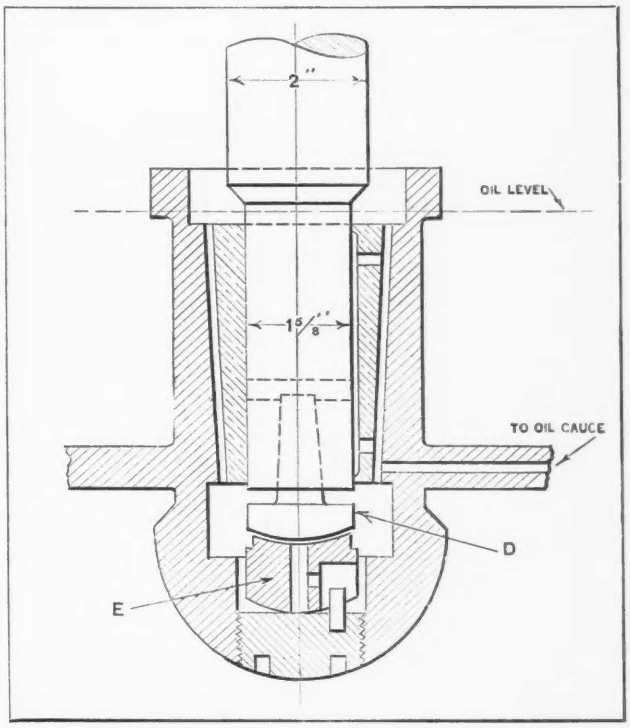

Fig. 2. Lower Spindle Bearing and Step Thrust Bearing of Machine Shown in Fig. 1

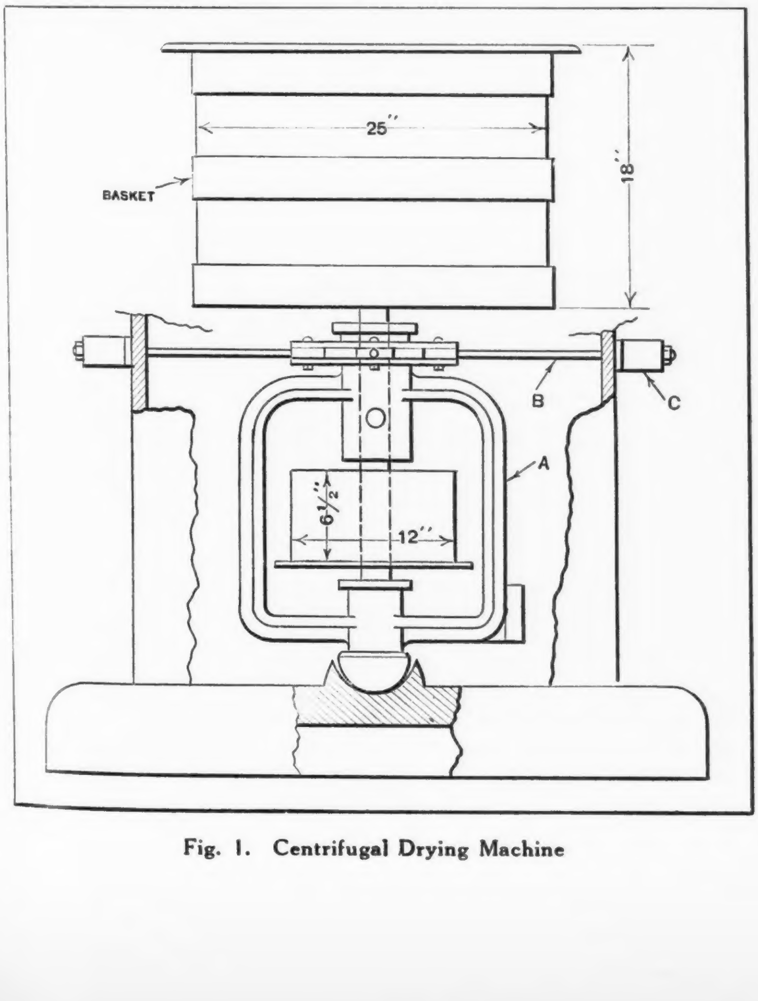

Fig. 1. Centrifugal Drying Machine

The pivot *D*, Fig. 2, was found to be in good condition, but the cup *E* was broken in half. A new tool-steel cup, as shown at *B*, Fig. 3, was made, and hardened and lapped to a fit. The machine was assembled and run without a load. In about three minutes, the bearing was so hot the machine had to be shut down. Examination of the step bearing showed that the pivot and cup had been damaged beyond repair. Nothing further was done until the writer's return.

The cause of the original trouble was diagnosed as an imperfect fit of the filter cloth lining, which allowed the load to shift continually. This later proved to be correct. The problem, then, was one of replacing the step bearing. The foreman stated that when the machine was taken down the first time, the pivot looked all

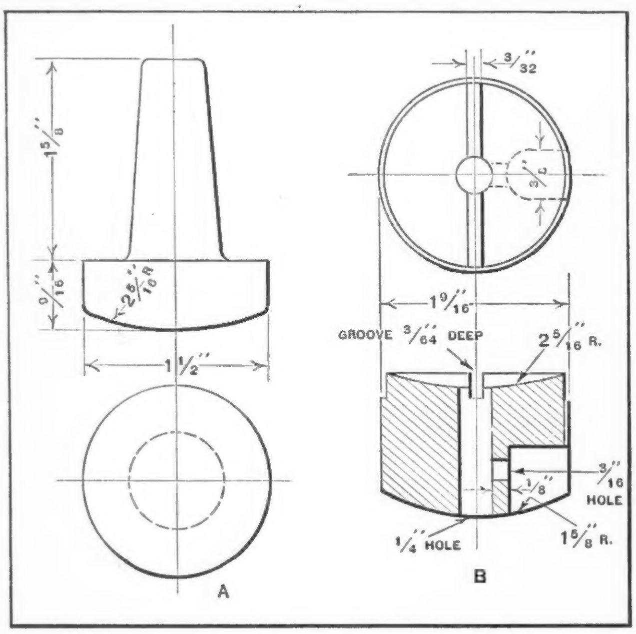

Fig. 3. Pivot and Cup of Step Bearing

right, and that the new cup had been made exactly like the original one. He had thrown the old cup away, but he was positive it was made of tool steel, as it was polished and very hard.

A new tool-steel pivot and cup were made, and carefully lapped to insure a proper running fit. The final lapping was done by mounting the shaft and pulley in the bearings without the basket, and driving these two members continuously for seven hours at 1000 revolutions per minute by means of a small electric motor. The lubricant used was a thin machine oil mixed with a small quantity of Vienna lime. The fit was so perfect that the pivot and cup would ring together dry, and both had a mirror polish, with no scratches visible under a strong magnifying glass.

The machine was again assembled and run for two hours without any sign of heating, and it ran for fourteen minutes after the power was shut off. Next day the oil was changed and the machine operated under load. The cup and pivot were ruined in less than five minutes. The matter was referred to the editor of a technical magazine and also to the chief engineer of a local engineering works. The former thought the trouble resulted from using the wrong kind of oil, the latter said the step bearing was incorrectly designed. Neither seemed to be correct, as the same kind of oil had been used for ten years, and the bearing of the other machine was still operating satisfactorily. The engineer stated positively—and was upheld by several of his draftsmen—that the groove should be in the pivot and not in the cup. This, it was claimed, would create a suction, and by means of this, oil would be drawn into the bearing.

As our machinists were busy, the engineering works was given a contract to make a new pivot and cup. A new tool-steel pivot with a groove as shown at *A*, Fig. 4, and a plain cup, were made. These lasted less than three minutes. A pivot and cup similar to the original ones shown at *A* and *B*, Fig. 3, were tried again, with no success. Various authorities were looked up, but no information could be obtained, and the contract was given up.

The local bearing metal manufacturers threw up their hands; they would give no guarantees on their metals at the speed, load, and small bearing surface specified. The situation was becoming desperate, as this particular product was being held up. It was then decided to dismantle the other machine and examine the step bearing. It was then found that the cup could not be readily removed. A small piece of the cup had been broken off and was lying at one side. Owing to the depth of the bearing, it was difficult to get the piece out. A long bar magnet was procured, but it would not attract the chip. Here was a possible solution of the problem. The cup was not made of steel.

The chip was finally fished out and carefully examined. On the rubbing or bearing surface it looked like silver and had a mirror polish. On the outer edge it was black and was so hard it would scratch a file. Our chemist stated that the piece was too small to permit making a correct analysis of the contents. At this stage of our difficulties a salesman called to talk over the problem of bearing metal for our rolling mills. The difficulty with the step bearing was explained to him. He said, "I have a new nickel babbitt that will do the trick, and will furnish you with enough to do the job."

The chief engineer already mentioned and several others were consulted, but they all ridiculed the idea. The salesman, however, was very positive regarding the merits of his new metal. A new hardened tool-steel pivot like the one shown at *A*, Fig. 3, with a nickel babbitt cup like the one shown at *B*, Fig. 4, were made. To insure proper circulation of the oil, a slotted sheet-iron disk *C*, 1/16 inch thick, was placed below the cup *B*.

After assembling the machine, it was run without load for about four hours, without any sign of heating. Next day the oil was changed and the machine put into service, and it has been running

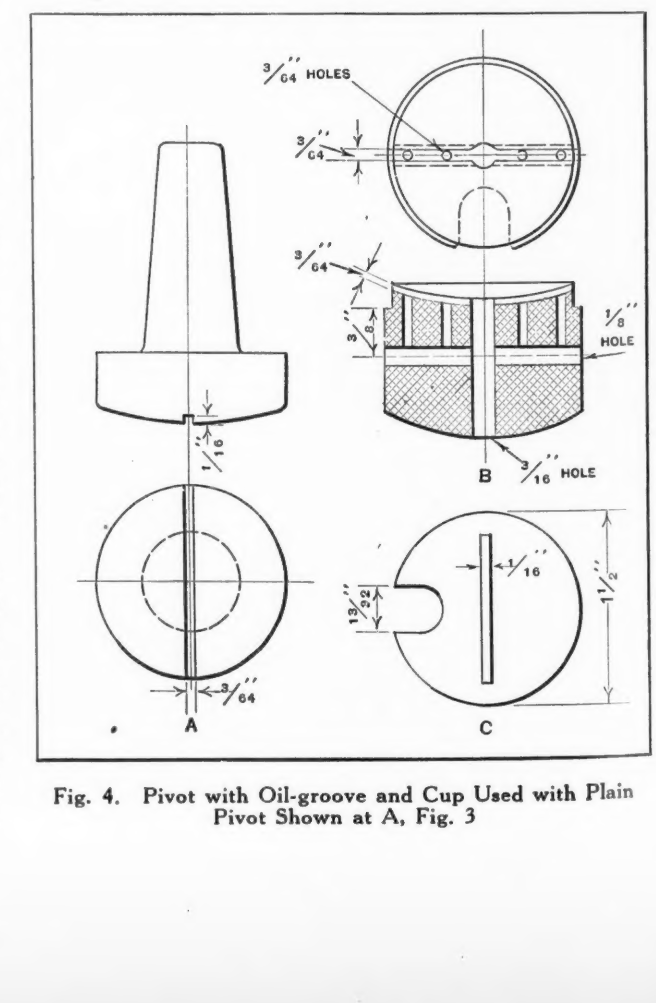

Fig. 4. Pivot with Oil-groove and Cup Used with Plain Pivot Shown at A, Fig. 3

for seven hours a day up to the present time without any trouble of any kind. The cup was examined recently, and except for a slight dragging of the metal at the groove, was in perfect condition and had a nicely polished surface. Careful measurements showed the wear to be less than 0.005 inch during this period. The load and speed on the step bearing is approximately 680 pounds per square inch at a speed of 250 feet per minute.

From the foregoing it would seem that a little proper reasoning at the beginning would have saved a lot of worry and bother. The other machine has been running for six years with the cup broken in three pieces. The last cup *B*, Fig. 4, was made from what is known as nickel babbitt. This metal is also used in the bearings of our rolling mills, and is an excellent metal for heavy pressures at all speeds.

* * *

THE BRITISH METAL-WORKING INDUSTRIES

From MACHINERY'S Special Correspondent

February 15, 1929

Having regard to the marked fluctuations in trade conditions during recent years, for which no satisfactory explanation is forthcoming, one hesitates to speak of the future in a wholly optimistic vein, but certainly it would appear that the metal-working industries as a whole are assuming a much more healthy aspect than has prevailed for some time. It is true that the coal mining industry still presents a problem of a magnitude hardly equalled in our industrial history, but even here the passage of time must provide a solution.

The Machine Tool Industry Remains Well Employed

As a whole, the machine tool industry remains well employed, and although some manufacturers in the North complain that conditions are improving but slowly, there must be very few, if any, who are not better placed as regards orders than has been the case for some time. A particularly welcome sign is the increased interest being shown in the heavier classes of machine tools, such as are required in the shipyards and marine engineering establishments. The automobile industry is also a good customer for machine tools at the present time.

The demand appears to be fairly evenly distributed among the various types of machine tools, but turret lathes and automatic screw machines, ball-bearing drilling machines, and milling machines would seem to be especially good selling lines at present. A number of firms find it necessary to work over-time, and night shifts are by no means unusual; nevertheless, there is, in many cases sufficient work on hand to insure full employment for several months.

Overseas Trade in Machine Tools Shows Gain During Past Year

Exports of machine tools in December were satisfactory, and the run of three consecutive good months just cancelled the effects of the poor September total. Whereas July and August indicated a lead in exported tonnage which has not been maintained, the past year has been, nevertheless, the best export year since 1921.

The actual tonnages of machine tools exported in December, November, and October were 1309, 1382, and 1327. The total value of the December exports amounted to £162,813, as compared with £165,214 for November, and £189,589 for October.

Over the last quarter of 1928, imports were much more erratic, the tonnages for October, November, and December being 725, 1090, and 648, respectively, with corresponding total values of £106,800, £163,905 and £117,982. It is interesting to note that while the ton values of imports and exports showed only a slight discrepancy in October, the figure for the former being £147, as against £143 for the latter, in November and December the import ton values were again substantially higher than those of exports.

During 1928, the loss of European trade in the years 1926-1927 was fully recovered; indeed the returns show a gain of 10 per cent by comparison with the 1925 total.

Shipbuilding Industry is Active

During the past year, 420 merchant vessels of 1,445,920 tons were launched in Great Britain and Ireland, the total representing 53.6 per cent of the world's output for the year. Among the various districts, the Clyde occupied first place, with an output of 571,948 tons. Except for Belfast, all other centers showed an appreciable increase.

It is interesting to note that the giant White Star liner now on the stocks at Belfast, which, when completed, will be the world's largest ship, is to be fitted with Diesel-electric drive. The four propeller shafts will be driven by electric motors, the current being supplied by generators coupled to a multiple set of Diesel engines. The largest craft at present equipped with this system of drive is a 12,500-ton oil-tanker, while the largest motor ship is the Italian liner *Augustus*, having an output of 25,000 horsepower. It is understood, however, that the new 60,000-ton ship may be designed to develop as much as 80,000 to 100,000 horsepower.

Important Orders have been Placed in Railway Shops—Activity Continues in Automobile Plants

While one would hesitate to say that builders of locomotives and rolling stock are generally well employed, some important orders have recently been placed in this country. Thus the firm of Wm. Beardmore is to build forty-four large locomotives for the Indian State Railways, the contract being valued at £350,000.

Automobile manufacturers continue to make satisfactory progress, those specializing in light cars being particularly busy. There is also a strong demand for the new light six-cylinder and eight-cylinder cars, which were introduced at the Motor Show last Autumn. The commercial vehicle section of the industry remains very active.

Aero-engine manufacturers are experiencing good business, and some important Continental contracts have recently been secured for air-cooled radial engines. Some of these engines have seven cylinders and develop 220 horsepower, while others are of the fourteen-cylinder type, developing 700 to 750 horsepower. Incidentally, these are stated to be the largest radial engines in the world.

Balancing Rotating Units in Service

Application of a Simple Portable Outfit for Detecting the Amount and Location of Static and Dynamic Unbalance without Dismantling the Equipment

By PETER DAVEY, Vice-president, Vibroscope, Inc., New York City

DURING the last few years there has been a general tendency to increase the speed of machinery. This has led to the development of balancing methods that have greatly raised the standard of machine performance by providing a means of eliminating vibration. It is now expected that all high-grade machinery, regardless of size, shall operate smoothly at all speeds.

Machines for balancing rotating units or parts before mounting them in their bearings are in general use and, in many cases, balancing by this method produces excellent results in the finished product. There are cases, however, where the balancing machine is not applicable or only partly applicable, and these can be classified as follows:

1. Cases where it is more expedient or quicker to balance the rotating unit after assembly in its bearings and while running under its own power.

2. Cases where a balancing machine has been used, but where some vibration still remains in the finished product due to the speed of rotation being higher than in the balancing machine, or due to some such condition as temperature change, which is only met with under actual operating conditions.

3. Cases where troubles have developed after the rotating unit has been in service, possibly due to the shifting of some part.

Principle of the Davey Dynamic Balancing Equipment

To meet the three cases outlined, the portable dynamic balancing equipment shown in Fig. 2 has been developed by the writer. It is manufactured by the Electrocon Corporation, 6 Varick St., New York City, under patents of Vibroscope, Inc., which is located at the same address. This equipment is easily attached to machines ranging from the largest turbines to units of only fractional horsepower in capacity. It is small, compact, and weighs only 20 pounds in its portable case.

This balancing equipment is based on the stroboscopic principle. Briefly, the stroboscopic principle consists of illuminating rapidly moving objects by a series of instantaneous light flashes so timed that they are in perfect synchronism with the motion of the moving objects. Thus, moving objects are made to appear stationary under the rays of the flashing light. The principle can be applied not only to rotary motions, but also to oscillating motions.

When a rapidly rotating shaft is illuminated by a series of instantaneous light flashes occurring once per revolution, the shaft will appear stationary no matter how fast it is rotating. If the instant at which the flash occurs in each revolution is changed, the shaft will appear to be stationary in a different position. That is to say, if the light flashes are advanced with respect to each revolution, the shaft will appear at rest further on in the course of its revolution. Conversely, if the light flashes are retarded, the shaft will appear to shift backward.

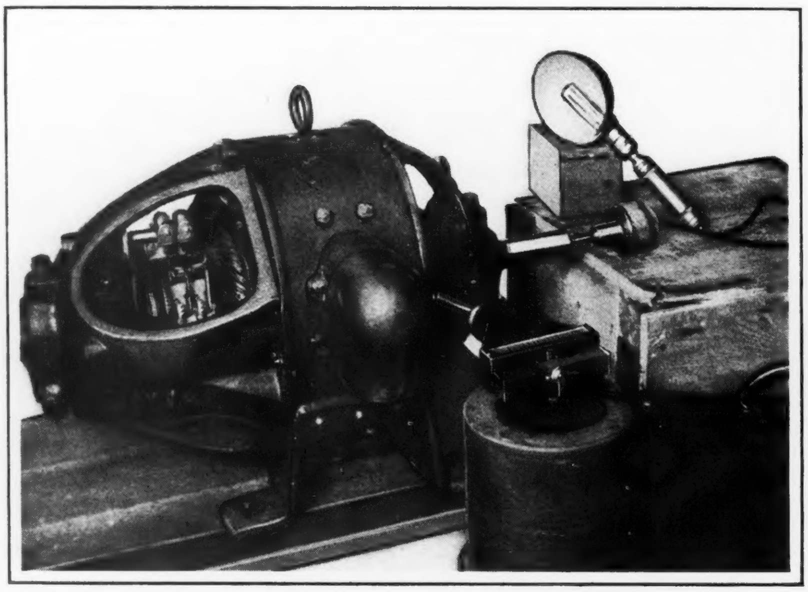

Fig. 1. Determining Unbalance in the Armature Shaft of a Motor

In balancing, we are interested in two motions, the rotary motion of the shaft and the vibratory motion of the machine frame in which the shaft is assembled. If the stroboscopic principle is applied to both of these motions, the relation between the two can be ascertained, and this is the information required in order to correct unbalance.

This portable balancing equipment consists of three main parts, which are illustrated in Fig. 2. Head *B* has a spindle which is driven by the shaft of the machine to be balanced, either through a special coupling or by means of a center similar to that used on a tachometer. The function of the head is to regulate the light flashes so that they occur once per revolution of the shaft. By means of a phase adjuster incorporated in the head, the light flashes can be made to occur at any desired position in the revolution. This adjuster is graduated in degrees, so that any setting can be definitely identified.

Hand lamp *A* embodies a special type of neon tube, the flashes of which are controlled by the head. This lamp illuminates the revolving unit, so that it appears stationary.

"Vibrometer" *C* is placed in contact with the vibrating machine and indicates not only the amount of vibration, but, also, the position of the machine frame in its vibratory path with respect to any point in the revolution of the rotor. The whole equipment is shown in Fig. 1, set up ready to determine the unbalance of a motor.

How Vibration Readings are Taken

The vibrations of the machine being balanced cause a small mirror in the "Vibrometer" to oscillate. Light is thrown on this oscillating mirror through a narrow slit and reflected on a ground-glass scale. The reflected light comes from two superimposed sources, there being a steady light from an incandescent lamp, and a flashing light from a small neon tube mounted in the "Vibrometer." This tube is controlled by the head in the same way as the neon tube in the hand lamp. The light from the incandescent lamp is white, while that from the neon tube is red.

Fig. 2. Davey Portable Dynamic Balancing Equipment and Case

Vibration Magnified Several Hundred Times

The vibration is magnified several hundred times, and the ground-glass scale is graduated to 0.0005 inch so that readings can be made conveniently. As the mirror oscillates, the strip of white light travels so rapidly back and forth that it appears to be a continuous band of light, and the width of this band indicates the amount of vibration. The red light, however, appears on the ground glass as a narrow strip of the same width as the slit through which it shines, since it only flashes once during each complete swing of the white-light beam.

Two full-size diagrammatic views of the center portion of the ground-glass scale are shown in Fig. 3. At *A*, the red-light beam appears half way between the limits set by the white band. However, by turning the phase adjuster on the head, as already explained, the revolving unit can be viewed under the rays of the hand lamp at various positions in its revolution. When the phase adjuster is turned, the red beam is seen at various positions within the limits set by the white band. At *B*, the red beam is shown at the extreme right-hand end of the white band, in the position it would reach if the phase adjuster were turned through 90 degrees from its previous setting when the red beam appeared in the midway position shown at *A*.

When the red beam travels toward the right, it indicates that the motion of the vibrating machine is toward the "Vibrometer," and if the phase adjuster is turned until the red beam reaches the extreme right-hand position, it indicates that the light is flashing each time that the vibrating machine reaches the end of its swing toward the "Vibrometer." Thus, the exact position of the machine frame at any point in the path of its vibration can be determined, and to establish the relation between this point and the corresponding position of the rotor, it is only necessary to illuminate the rotor with the hand lamp.

Finding the "High Spot" of Unbalanced Units

A unit to be balanced is usually marked with a series of chalk numbers previous to beginning the balancing operation, so that any point on its periphery can be definitely identified. Alternatively, a light disk with numbers marked around it may be mounted on the shaft.

The point on the revolving unit which corresponds to the extreme deflection of the vibrating machine in one direction is referred to as the "high spot." Reference to Fig. 4 will make clear the method of finding this "high spot." In the case illustrated, when the phase adjuster is so set that the red beam reaches the extreme right-hand side of the white band, the rays of the flashing lamp will reveal the revolving unit as standing still with No. 6 on the unit adjacent to the "Vibrometer." The "high spot" of the rotor is, therefore, along a horizontal center line extending axially from point No. 6. The actual operation of finding a high spot by this method is a matter of but a few seconds.

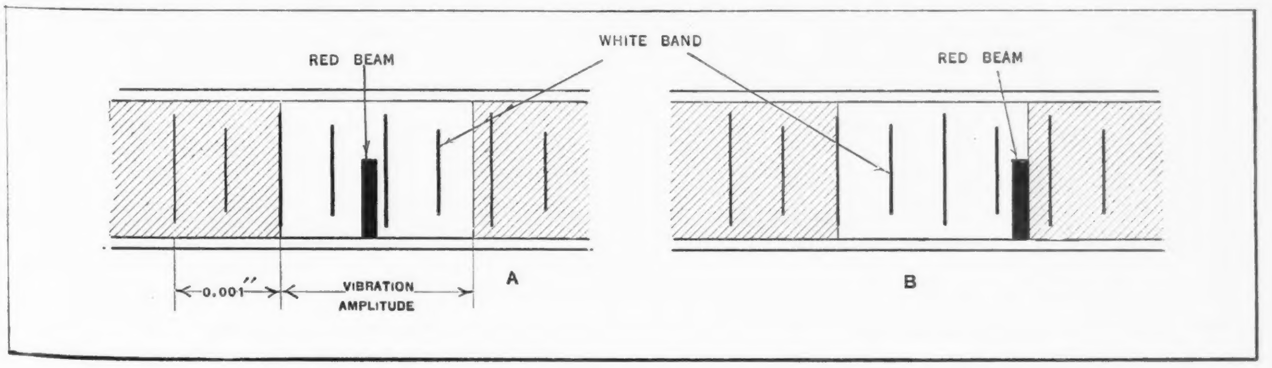

Fig. 3. Diagrams Illustrating Manner of Taking Readings from the Ground-glass Scale of the "Vibrometer"

Determining the Angle of Lag

It is a well known fact that the "high spot" of a rotating part and the heavy spot that causes the vibration as the part whirls around do not exactly correspond. The vibratory motion lags behind the rotary motion, and the amount of this lag increases with the speed. The angle between the high spot and the heavy spot is known as the "angle of lag." At low speeds, the angle of lag is small; at the critical speed or that speed of rotation which corresponds with the natural period of vibration of the machine as a whole, the angle of lag is 90 degrees; and at high speeds, the angle of lag approaches 180 degrees.

When it is practicable to reverse the direction of rotation, the common method of finding the heavy spot of a part is to take a high-spot reading in each direction. The point half way between the two high spots thus obtained is the location of the heavy spot. However, in many cases, it is not practicable to run the unit under observation in both directions, and it is difficult to estimate the angle of lag. In such cases, the angle can be rapidly found with the Davey dynamic balancing equipment.

The general characteristic of the angle of lag for an average case is shown in Fig. 5, in which this angle is plotted against the speed of rotation. From the curve it will be seen that the angle of lag increases slowly until the critical speed is approached, when it jumps up suddenly, passing through 90 degrees at the critical speed. After a further slight increase of speed, the curve flattens out again, with the angle of lag nearly approaching 180 degrees.

From this curve it will be apparent that any method of quickly determining whether a rotor is running at a speed corresponding to the steep or to the gradual slope will be of great value in arriving at the angle of lag.

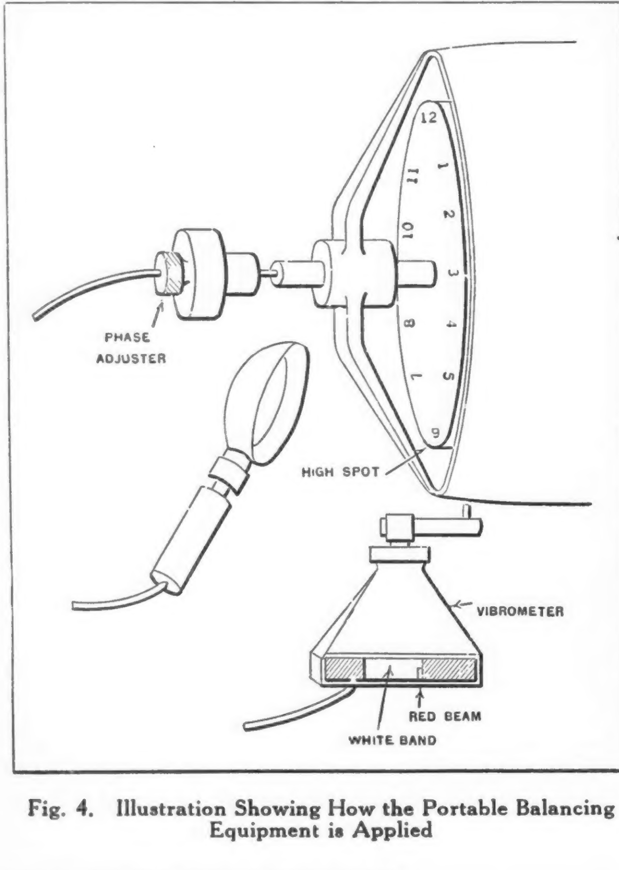

Fig. 4. Illustration Showing How the Portable Balancing Equipment is Applied

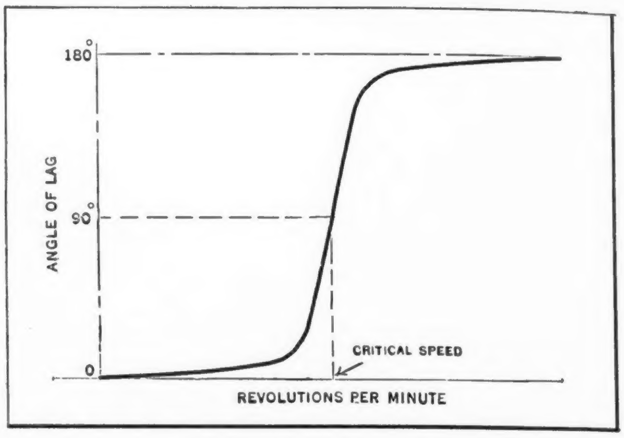

Fig. 5. Curve Showing How the Angle of Lag Changes with Different Speeds

Now suppose that the phase adjuster of head *B*, Fig. 2, is so set that the red beam is at the extreme right-hand end of the white band on the ground-glass scale of the "Vibrometer," and that the power of the machine being balanced is shut off so that the machine slows down. If the red beam tends to remain near its position at the right-hand extremity of the white band during a considerable slowing down of the rotating unit, and then travels toward the left, it shows that the unit was running at a speed corresponding to the gradual slope at the top of the curve. If, on the other hand, the red beam starts to travel toward the center of the white band as soon as the rotor begins to slow down, it indicates that the speed corresponded to the steep slope of the curve. Or again, should the red beam remain near the right-hand extremity of the white band, until the rotor comes to rest, it indicates that the speed of rotation corresponded to the gradual slope at the bottom of the curve.

A little practice makes possible close first estimates of the angle of lag, and if the first estimate is not quite correct, the application of a simple rule makes an accurate determination of the angle practically certain on a second trial. When a number of rotating parts or units, similar in every respect, have to be balanced and they are run under the same conditions, the angle of lag will be the same in each case.

Determining Whether the Unbalance is Static or Dynamic or a Combination of Both

It is well known that revolving units may be subject to static or dynamic unbalance or both. If the rotor indicated diagrammatically at *A* in Fig. 6 is thrown out of balance by weight *W*, which lies in approximately the same plane perpendicular to the axis of rotation as its center of gravity, static unbalance will exist. This unbalance will cause the rotor to vibrate in a path parallel to its axis of rotation, as indicated by the arrows, and a single weight equal to *W*, applied diametrically opposite, will correct it.

Now, suppose weight *W* were applied to the rotor at one side of the center of gravity, as shown at *B*, and suppose an equal weight were added on the opposite side at *X*, in an effort to correct it. Weight *X* would also obviously correct the static unbalance here obtained, but a dynamic unbalance would be introduced. This unbalance would cause

the rotor to vibrate about a fulcrum point, which would be the center of gravity, due to weights *W* and *X* pulling in opposite directions, as indicated by the arrows. It will thus be seen that a rotor can be statically balanced, but still be dynamically out of balance; that it can be in dynamic balance, but still statically out of balance; and that it can have a combination of static and dynamic unbalance.

The condition of unbalance existing in a rotor can be quickly determined with the Davey dynamic balancing equipment by setting the phase adjuster of head *B*, Fig. 2, so that the red beam on the "Vibrometer" scale will occupy the position at the extreme right-hand end of the white light band, when the "Vibrometer" is brought in contact with one end of the machine. Then, without touching the phase adjuster, the "Vibrometer" should be applied to the other end of the machine. If the red beam stays at the right-hand end of the white light band, a condition of static unbalance exists; if the red beam shifts over to the left-hand end of the white band, dynamic unbalance is indicated; and if the red beam takes up some other position within the white band, combined static and dynamic unbalance is indicated.

Static and Dynamic Unbalance Corrected Separately

Cases where static or dynamic unbalance exist singly are easily corrected, but great difficulty often attends cases where the two conditions exist together. In such cases, it is frequently found that an adjustment of weight which corrects the vibration at one end of a part or machine will throw it over to the other end. Because high spot readings can be obtained with Davey dynamic balancing equipment at any point on the frame of a machine, regardless of whether an exposed shaft is available or not, it is possible to correct static and dynamic unbalance separately with this equipment.

Assuming that a rotor mounted in a frame such as indicated in Fig. 7 is to be balanced, the frame of the machine would be investigated at different points with the "Vibrometer." If at any point zero vibration is registered, this will indicate that the rotor is statically balanced, and that dynamic unbalance is causing the rotor to vibrate about the point where the zero reading is obtained.

Supposing that vibration amplitudes of 0.003 inch are obtained at points *A* and *B* of a machine, and at point *C* the minimum amplitude of 0.001 inch is indicated. Such a reading will show the rotor to be statically unbalanced to the extent of 0.001 inch and dynamically unbalanced to the extent of 0.003 — 0.001 = 0.002 inch.

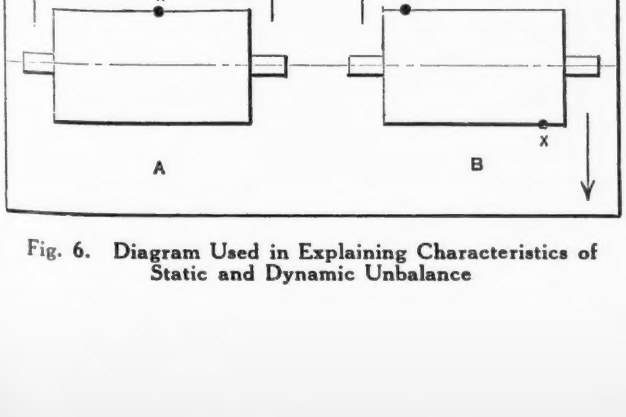

Fig. 6. Diagram Used in Explaining Characteristics of Static and Dynamic Unbalance

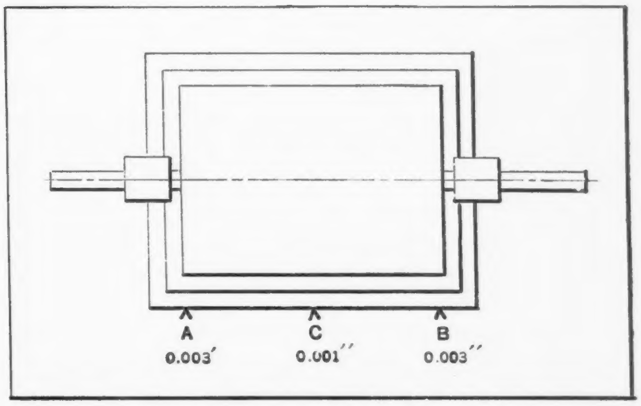

Fig. 7. Diagram Illustrating Manner of Investigating a Rotor out of Balance

Readings should be taken with the "Vibrometer" at point *C* and the necessary weight corrections made until the vibrations at that point are reduced to within the required limit. The rotor will then be statically balanced, and only dynamic unbalance will be left. If the "Vibrometer" is now applied to one end, and for any weight adjustment made at that end, an equal adjustment is made diagonally opposite at the other end, the dynamic unbalance will also be corrected.

The head and hand lamp referred to in this article form a unit known as the "Vibroscope." This unit is available separate from the "Vibrometer" for observing high-speed mechanisms in motion, as described in an article published on page 19 of September, 1925, MACHINERY. The "Vibrometer" may also be used alone for acceptance tests on motors and similar equipment.

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ABRASIVES IN PRODUCTION GRINDING

In a paper read by B. H. Work of the Carborundum Co., Niagara Falls, N. Y., at the annual meeting of the Society of Automotive Engineers in Detroit, an interesting review of the subject of abrasives as used in present-day grinding wheels was presented. The author covered the efforts directed toward standardization of abrasive wheels, the cutting action characteristics of modern abrasive wheels, and the multiplicity of materials and methods at the disposal of abrasive manufacturers in meeting the demand for maximum production at low cost. Copies of the paper may be obtained from The Society of Automotive Engineers, 29 W. 39th St., New York City.

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IMPROVED TRADE STATISTICS

The Federal Trade Commission has sent to the United States Senate a report of its investigation of open price associations, and has recommended to the Senate that the practical application of the anti-trust laws be clarified with reference to the circulation of identified price and statistical information. It has also recommended that trade associations be given a definite place and responsibility by a licensing system, designed not so much as an instrument of regulation, as an important means of providing the Government with full knowledge of the work that the trade associations are doing.

The Grinding of Tungsten Carbide Tools

Detailed Directions for Grinding Tools Made from the Newly Introduced Tungsten Carbide Cutting Alloys

By A. H. PREY, Engineer, The Carborundum Co., Niagara Falls, N. Y.

MUCH has been written describing tungsten carbide alloy—the new tool material—its extreme hardness, the amazing speed at which it will remove metal, the radical change in machine design necessary to utilize it at its greatest efficiency, and its probable effect upon the industry as a whole; but very little, if anything, has been written concerning the problem of grinding it; and this is indeed a problem. It is the purpose of this article to discuss briefly only the "off-hand" grinding problems confronting the user of tungsten carbide tools.

The chief characteristic of tungsten carbide is its extreme hardness. Various Brinell figures show hardnesses from 1800 to 2400, compared with a maximum of about 800 for hardened high-speed steel when determined in the same manner (Rockwell, no load, converted to Brinell figures). The new material will scratch sapphire, and its hardness lies between that of fused alumina and silicon carbide. It is apparent, then, that an aluminous abrasive is out of the question for use on this material, and we must go to the harder abrasive, silicon carbide, for which one manufacturer has adopted the trade name Carborundum.

Tungsten carbide material for tools is supplied to the trade at present in two forms—one a finished tool ready for use, and the other a roughly shaped piece to be mounted and ground to its final form by the customer. Therefore, from the user's standpoint, there are two grinding problems involved when he mounts his own tool, and there is only one when he buys the finished tool.

In the first case, the tool must be ground to its final form and finish-ground to secure the proper sharp edge, a relatively large amount of stock being removed. A soft wheel, grades P to V (Carborundum Co.'s grading) and grits 40 to 60 in W bond are recommended for this work. After forming, there remains only the problem of regrinding, which will be described later. It must be kept in mind that shop conditions vary widely in different plants, and this influences the wheel selection.

Regrinding of Tungsten Carbide Tools

The regrinding should, the author believes, consist of three operations: (1) rough-grinding; (2) finish-grinding; and (3) stoning or honing.

The rough-grinding brings the tool to its proper shape, and the finish-grinding and stoning give a smooth finish and a sharp edge. The makers of this material emphasize the importance of an edge free from grinding marks, if it is to be most efficient in use, and it is believed that the combination of a finish-grind on a fine grit wheel followed by a hand-stoning operation with a small Carborundum stone will give the proper cutting edge. It may be possible to eliminate operation (1) when the point of the tool is not badly worn, but when considerable stock is to be removed, it should be carried out.

For these operations the following Carborundum gradings are recommended: (1) rough-grinding, 60 grit, N to U grades, W bond wheels; (2) finish-grinding, 100 to 120 grit, S to V grade, W bond wheels; (3) stoning, any fine grit, medium grade Carborundum stone, say, 4 by 1 by 1/2, 2F-G6.

Precautions in Grinding Tungsten Carbide Tools

In addition to the selection of the proper grinding wheels for a good cutting edge, there are several points in grinding that should be watched. Wheel speeds should be low rather than high. From 4000 to 5000 surface feet per minute is about the correct range. The pressure of the tool against the grinding wheel should be light; otherwise excessive wheel wear will result, with no faster cutting action. A higher wheel wear than when grinding high-speed steel must be expected. In the efficient use of the tools made from these new alloys, the clearance and tool angles differ from those that are standard for high-speed steel, and the manufacturer's specifications should be followed closely.

A rigid machine is essential; otherwise the wheel wear will be excessive. The tool should be supported on a solid rest, as, if only applied by hand, without a rest, "bumping" will take place, and the wheel, which is very soft, will quickly get out of true. The tool should approach the wheel carefully, and the heel should come in contact first; otherwise, the tool will dress the wheel, or, at best, a very ragged and chipped edge will result.

Should Water be Used in Grinding Tungsten Carbide Tools?

There seems to be some disagreement among the various manufacturers of tungsten carbide relating to the use of water in grinding. It is enough to say here that if water is used, the supply should be plentiful, as a little is worse than none. The heat conductivity of this material is low, and there is danger of localized heating and checking.

There is some indication at present that different wheel gradings will be necessary for use on materials of different makes, but this will have to be determined by additional experiments and tests.

The use of this new tool material is still in the experimental stage—consequently the grinding problems are not yet completely solved. A material having characteristics so radically different from those of high-speed steel requires time to be developed to its utmost efficiency, and the grinding wheels must develop along with it. This article has dealt only with "off-hand" grinding. Machine grinding of this material on any of the several tool grinders is distinctly another problem, which is still in the experimental stage but is being given close study.

MACHINERY'S DATA SHEETS 149 and 150

WEIGHTS, IN POUNDS, OF CAST-IRON FLANGES ONE INCH THICK—1

To Find Weight of Any Flange, Multiply Value in Table by Thickness of Flange.
For Cast-steel Flanges, Multiply Weight for Cast Iron by 1.093

Inside Diameter of Cylinder	Width of Flanges, in Inches, Measured from Inside of Cylinder to Outer Rim of Flange										
	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	4
2′–0″	31.2	36.8	42.5	48.3	54.1	60.7	66.1	72.4	78.6	85.0	91.5
2′–6″	38.7	45.4	52.1	59.3	66.3	73.3	80.4	88.3	95.8	103.4	111.1
3′–0″	45.9	54.0	62.1	70.5	78.5	87.1	95.6	104.4	112.8	121.8	130.6
3′–6″	53.3	62.6	71.9	81.3	90.8	100.5	110.0	120.0	130.0	140.1	150.3
4′–0″	60.6	71.3	81.8	92.4	103.1	113.9	124.8	136.0	147.2	158.3	169.9
4′–6″	68.0	79.7	91.5	103.5	115.4	127.3	139.6	151.9	164.5	176.5	189.5
5′–0″	75.3	88.3	101.3	114.4	127.4	140.8	154.3	167.9	181.6	195.0	209.1
5′–6″	82.7	96.8	111.1	125.5	139.5	154.3	169.0	183.8	198.6	213.3	228.9
6′–0″	90.1	105.4	120.9	136.7	152.0	167.8	183.8	199.7	215.8	231.7	248.2
6′–6″	97.4	113.9	130.8	147.7	164.3	181.2	198.4	215.8	233.0	250.0	267.9
7′–0″	104.7	122.7	140.5	158.5	176.5	194.6	213.0	231.5	250.0	268.3	287.5
7′–6″	112.1	131.1	150.2	169.5	188.7	208.0	227.8	247.5	267.1	286.8	307.2
8′–0″	119.5	139.7	160.0	180.5	201.1	221.7	242.5	263.5	284.2	305.5	327.0
8′–6″	126.8	148.3	169.9	191.5	213.3	235.5	257.2	279.3	301.5	323.8	346.9
9′–0″	134.2	156.9	179.8	202.5	225.5	248.8	272.0	295.1	318.9	342.3	366.1
9′–6″	141.5	165.5	189.5	213.5	237.2	262.0	286.5	311.0	336.0	360.8	385.9
10′–0″	148.9	174.1	199.8	224.6	250.0	275.5	301.2	327.0	353.1	379.2	405.5
10′–6″	156.2	182.7	209.1	235.6	262.3	289.0	316.1	343.0	370.3	397.5	425.0
11′–0″	163.5	191.3	218.9	246.7	274.5	302.5	331.0	358.9	387.4	415.9	444.9
12′–0″	178.2	208.5	238.5	268.7	299.0	329.6	360.5	391.0	421.8	452.8	484.0
13′–0″	193.3	225.5	258.1	290.8	323.5	356.5	389.9	422.5	456.0	489.3	523.0
14′–0″	207.6	242.7	277.5	312.7	348.0	383.5	419.0	454.5	490.5	526.0	562.1
15′–0″	222.2	259.9	297.3	335.0	372.5	410.5	448.0	486.3	524.3	562.8	601.5

MACHINERY'S Data Sheet No. 149, New Series, March, 1929

Contributed By Harold Ball

WEIGHTS, IN POUNDS, OF CAST-IRON FLANGES ONE INCH THICK—2

To Find Weight of Any Flange, Multiply Value in Table by Thickness of Flange.
For Cast-steel Flanges, Multiply Weight for Cast Iron by 1.093

Inside Diameter of Cylinder	Width of Flanges, in Inches, Measured from Inside of Cylinder to Outer Rim of Flange								
	4½	5	5½	6	6½	7	7½	8	8½	9
2′–0″	104.8	118.4	132.5	147.0	162.0	177.3	193.0	209.0	225.5	242.5
2′–6″	126.8	143.0	159.5	176.4	193.8	211.5	229.9	248.1	268.1	286.7
3′–0″	148.9	167.4	186.5	205.8	225.8	245.8	266.5	287.3	309.0	331.0
3′–6″	171.0	192.0	213.2	235.1	257.5	280.0	303.1	326.8	351.9	375.0
4′–0″	193.0	216.4	240.3	264.3	289.3	314.3	340.0	366.0	392.0	419.5
4′–6″	215.0	241.0	267.3	294.0	321.5	349.0	377.0	405.1	434.0	463.2
5′–0″	287.0	265.4	294.2	323.8	353.3	383.5	413.7	444.7	475.9	507.7
5′–6″	259.1	290.0	321.3	353.0	385.0	417.5	450.5	483.9	517.5	551.7
6′–0″	281.2	314.4	348.4	382.3	417.0	452.0	487.2	522.5	559.0	596.0
6′–6″	303.1	339.3	375.3	412.0	449.0	486.0	524.0	562.0	601.0	639.5
7′–0″	325.5	363.8	402.3	441.3	480.8	520.1	560.5	601.7	642.5	684.0
7′–6″	347.5	388.3	429.1	471.0	512.4	554.5	597.5	640.2	684.0	728.0
8′–0″	369.8	412.8	456.3	500.1	544.3	588.8	634.1	680.0	726.0	772.0
8′–6″	391.8	437.3	483.5	530.0	576.8	623.5	671.5	719.0	767.5	816.0
9′–0″	413.9	461.8	510.0	558.5	608.2	658.0	708.0	758.2	809.0	861.0
9′–6″	435.9	486.3	537.1	588.3	639.0	692.0	744.3	797.7	851.0	904.0
10′–0″	457.8	511.0	564.0	618.0	672.0	726.5	781.8	837.5	892.5	949.0
10′–6″	480.0	535.5	590.8	647.0	704.2	761.0	818.0	876.0	934.0	993.0
11′–0″	502.0	560.0	617.9	677.0	735.0	795.5	854.5	915.0	976.0	1036.0
12′–0″	546.0	609.0	672.0	735.0	799.0	864.0	928.2	994.0	1059.0	1125.0
13′–0″	590.0	658.0	726.0	794.0	862.3	933.0	1002.5	1072.5	1142.0	1212.5
14′–0″	634.0	707.0	780.0	853.0	926.0	1002.2	1075.0	1150.0	1225.0	1301.0
15′–0″	678.1	756.0	834.0	912.0	991.0	1069.9	1149.0	1228.0	1308.0	1390.0

MACHINERY'S Data Sheet No. 150, New Series, March, 1929

Contributed By Harold Ball

Fair Trade Practices Gaining in Industry

The Woodworking Machinery Manufacturers Have Adopted a Set of Rules Clearly Defining What are to be Considered Unfair Trade Practices

THE woodworking machinery manufacturers, in cooperation with the Federal Trade Commission, have adopted a set of rules defining unfair trade practices. These rules, which may serve as a guide in any machinery industry or in industries generally, have been published by the Federal Trade Commission and are now in effect in the woodworking machinery industry.

The rules are grouped under two headings. Those in Group I are affirmatively approved by the Federal Trade Commission, and among the practices definitely prohibited are: Inducing breach of contract; false statements concerning the manufacturer's own product, or concerning a competitor's product; secret rebates; price discrimination; non-adherence to published prices; sale of a new machine as a repossessed or rebuilt machine; paying commissions to employes of customers for the purpose of inducing sales.

The rules in Group II are accepted by the Federal Trade Commission as an expression of the trade's conception of fair trade practices, and deal with the following subjects: Granting of either selling commissions or dealer's discounts to other than an established dealer; quoting prices f.o.b. factory; regarding as separate transactions the acceptance of an old machine in part payment of the price of a new machine; guaranteeing against advance or decline; terms of sale.

Federal Trade Commission Defines Unfair Trade Practices

The rules in Group I, as quoted directly from the statement by the Federal Trade Commission, are as follows:

Rule 1—Inducing of employes of competitors to violate contracts or enticing away of employes of competitors in such numbers or under such circumstances as to constitute conversion and an appropriation of the value created, at the expense of the said competitor, is unfair trade practice.

Rule 2—Manifestly false statements by a manufacturer, agent, dealer, or seller concerning the size, weight, working range, design, material, condition, or performance of any of his own machines or parts thereof, is unfair trade practice.

Rule 3—Manifestly false statements by a manufacturer, agent, dealer, or seller concerning the size, weight, working range, design, material, condition, or performance of any competitor's machine, or part thereof, or the circulation of false statements or false reports of a disparaging nature concerning the personnel or the financial standing of competitors, is unfair trade practice.

Rule 4—The payment or allowance to any customer of secret rebates, refunds, credits, or unearned discounts, whether in the form of money or otherwise, is unfair trade practice.

Rule 5—Any discrimination in price between purchasers of the same class (not including discrimination in price on account of the difference in grade, quality, or quantity of the product sold, or which makes only due allowance for difference in cost of selling and transportation), or discrimination in price in the same or different communities not made in good faith, to meet competition, where the effect of such discrimination may be to substantially lessen competition or tend to create a monopoly, is an unfair trade practice; Provided, however, that nothing in this resolution shall be construed to prevent the use, when published as defined under Rule 6, of a special quantity price, applicable to a definite quantity of goods which are placed in one order and are shipped as promptly as possible.

Rule 6—The members of the woodworking machinery industry, both manufacturers and dealers, while maintaining absolute freedom in the issuance of price schedules from time to time, in conformity with the established trade practices, do adopt as a cardinal principle that there shall be no discrimination as between purchasers of their product, and that all published prices as issued by any member shall set forth plainly the price and terms and conditions, and that such published prices shall truly represent the sales price in all cases where the goods sold and conditions and terms are set forth in the member's price schedule, and any deviation from the principle expressed herein shall be deemed an unfair trade practice; Provided, however, that nothing in this rule shall be construed as an obligation to anyone to maintain any price any length of time.

Published prices in this industry are defined as such prices as are set forth in a regularly issued schedule and distributed to agents, salesmen, dealers, or buyers.

Rule 7—The sale or offer for sale of a new machine as a repossessed or rebuilt machine, with accompanying price discrimination to favor buyers, is an unfair trade practice.

Rule 8—The payment (or promise to pay) to any employe of a customer, or prospective customer, of a commission or consideration of any character for the purpose of inducing or compensating for a sale, is unfair trade practice.

Other Unfair Trade Practices as Defined by the Woodworking Machinery Industry

The rules in Group II, as published by the Federal Trade Commission, are as follows:

Rule 9—Granting of either a selling commission or dealer's discount to any concern or individual other than an established woodworking machinery dealer or salesman is unfair trade practice.

Rule 10—As much confusion has arisen in the industry, resulting in many instances in price dis-

crimination, as a result of members of the industry selling their products on a basis of free delivery in some instances, and in others selling the same f.o.b. factory, we agree that all selling shall be based on delivery f.o.b. point of manufacture, and that when delivery at any other point is necessary, the proper transportation and handling charges shall be added to such f.o.b. factory price, and that any variation from this practice shall be deemed to be an unfair trade practice.

Rule 11—The industry recognizes the fact that where the customer for a new machine is also disposing of an old machine, there are two distinct transactions involved, one being the sale of the new machine and the other being the purchase of the old machine. Therefore the industry agrees that these two transactions shall be held distinct.

Rule 12—The sale or offering for sale of any product of the woodworking machinery industry under any form of guarantee to the purchaser or prospective purchaser against either advance or protection against the decline in the price of said product is an unfair trade practice.

Rule 13—The industry hereby records its approval of the practice of making the terms of sale a part of all published price schedules, and the failure on the part of manufacturers or manufacturers' agents or dealers to strictly adhere to such terms of sale, or to willfully fail to enforce collection under such, shall be deemed an unfair trade practice.

Rule 14—The willful interference by any person, firm, or corporation, by any means or device whatsoever, with any existing contract or firm order between a seller and a purchaser of any product of the woodworking machinery manufacturing industry, such interference being for the purpose or with the effect of dissipating, destroying, or appropriating in whole or in part the patronage or business of another engaged in such industry, is unfair trade practice.

* * *

LINK-BELT GASOLINE-ENGINE LOCOMOTIVE CRANES

Locomotive cranes designed especially to be driven by gasoline engines, Diesel engines, or electric motors have been added in five sizes to the cranes built by the Link-Belt Co., Chicago, Ill. In each of these L-type cranes, the power is delivered from the engine or motor through a totally enclosed silent chain drive, the machinery being particularly adapted to a direct drive. The cranes are furnished with a two-speed travel gear, which gives a high speed for traveling light, and a slower speed for pulling heavy loads or ascending comparatively steep grades. This two-speed travel gear does not affect other speeds, such as boom hoisting and rotating.

What Causes Ball Bearing Troubles?

Most of the troubles with ball bearings are caused by the user not following the directions for their mounting and care that are given by the bearing manufacturer. These directions give the bearing user all the necessary information as to what to do and what to avoid in order that the bearings may function properly and live to a good old age. Many users, however, do not take the time to read these directions and, as a result, when trouble arises, the bearing is believed to be defective. The article entitled "What Causes Ball Bearing Troubles?" in April MACHINERY will be the first of three articles in which the causes of ball bearing troubles will be thoroughly discussed. Every ball bearing user will find these articles profitable.

MACHINERY ASSOCIATION CONFERENCE

A conference of representatives of machinery and equipment associations was held in the Chamber of Commerce of the United States Building at Washington, D. C., February 14. One of the important developments of the meeting was the appointment of a committee to present to the next conference a proposed organization plan for a federation of machinery and equipment trade associations—a federation that would be able to handle the problems common to all manufacturers engaged in machine and equipment building and allied industries. Such a federation would be somewhat similar to the American Engineering Council, which is an organization representing the leading engineering societies throughout the country in matters in which all engineers are interested.

At present, there is no organization that can speak authoritatively for the entire machinery industry, and as a result this great industry, second in size only to the textile industry, has practically no representation in matters where governmental policies are concerned.

Among other subjects discussed at the meeting were free engineering service, trade-ins, uneconomic trade practices, commercial arbitration, the elimination of unfair practices, trade practice conferences, and obsolescence of machinery and equipment—all problems that concern the entire machinery industry. The meeting was attended by representatives of twenty-three trade associations in the machinery and allied fields, as well as by representatives of the American Society of Mechanical Engineers and of leading trade journals in the machinery industry.

* * *

RESEARCH SCHOLARSHIPS

To assist in the conduct of engineering research and to extend and strengthen the field of its graduate work in engineering, the University of Illinois maintains fourteen Research Graduate Assistantships in the Engineering Experiment Station. Two other such assistantships have been established under the patronage of the Illinois Gas Association. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics, or applied chemistry.

Applications for appointment to these positions should be sent to Dean M. S. Ketchum, College of Engineering, University of Illinois, Urbana, Champaign, Ill., before April 1, 1929. Further information relating to the Graduate Assistantships may be obtained by addressing Dean Ketchum.

New Machinery and Shop Equipment

A Complete Monthly Record of New Metal-working Machinery, Tools, and Devices for Increasing Manufacturing Efficiency and Reducing Costs

NORTON AIRPLANE-ENGINE CAM GRINDING MACHINE

Radial-type engines of the airplane industry make use of cams quite different from those on the camshaft of the conventional automobile or tractor engine. The cams for radial-type engines are generally much larger and have contours with several lobes or high points, adjacent to which there are reentrant curves of comparatively small radii. Two such cams are usually made integral, separated by a small space, and are not attached to a shaft or other engine part for grinding.

Automobile cams, on the other hand, seldom have reentrant curves in their contours, and in the rare cases where such curves are required, the radius is seldom less than 3 or 4 inches. Contours of automobile cams are usually ground with wheels 18 inches in diameter. In a few cases, special attachments have been furnished by the Norton Co. to permit the use of smaller wheels, from 6 to 10 inches in diameter, for grinding an occasional automobile cam with a reentrant curve. Radial-type engine cams, however, have reentrant curves of such small radii that grinding wheels less than 1 1/2 inches in diameter are sometimes required to finish the contours.

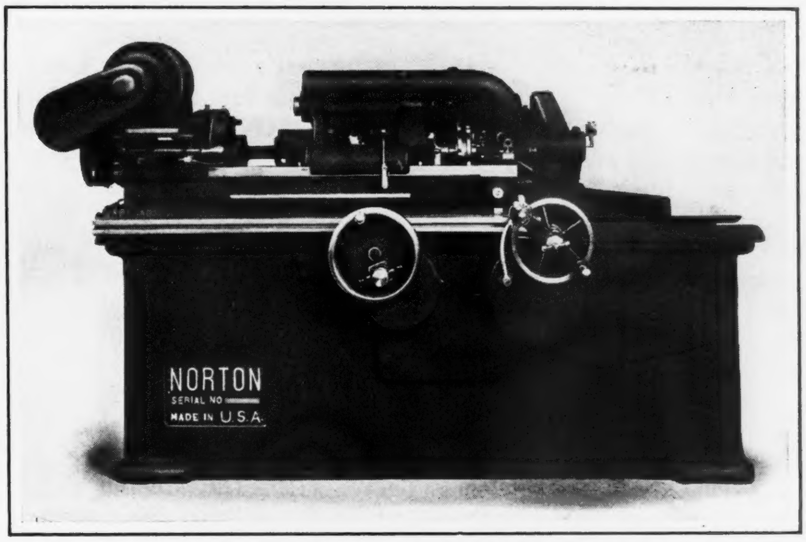


Fig. 1. Norton Grinding Machine Arranged for Grinding the Cams of Radial-type Airplane Engines

To meet these requirements in the grinding of cams for radial-type engines, the Norton Co., Worcester, Mass., has developed a special machine arrangement on which very small grinding wheels can be used, as shown in the illustrations. In Fig. 1 is shown the front view of this machine. It is equipped with a motor-driven grinding-wheel spindle and a cam grinding attachment suitable for large-diameter loose cams. This attachment is driven from a special headstock having an extra speed reduction which gives the slow rotating work speeds necessary in grinding this type of cam. Fig. 2 shows an end view of the equipment. A pair of test cams may be seen here in the grinding position, the grinding wheel being in contact with a point or lobe on the further cam. Three motors are employed for driving the pump, wheel-spindle, and headstock.

Grinding these airplane-engine cams with small wheels is necessarily a much slower operation than grinding automobile cams. In the first place, the surface to be ground, or the length of the contour, is several times greater, and this, in itself, necessitates a slow revolution. Then, also, the smaller the radius of the reentrant curves, the slower the revolution should be in order that the roller may follow the master cam and the grinding wheel have time to cut. Finally, it is impossible for a very small grinding wheel to remove metal as rapidly as a large wheel.

Wear of the grinding wheel is always an important factor in cam grinding, as a small reduction in the size of the wheel will affect the shape of the cam contour. When small wheels are used on large cams, the wheels wear rapidly, and for very accurate work, the final finish-grinding must be accomplished with a new wheel of the same diameter, within close limits, as the roller used in generating the master cams.

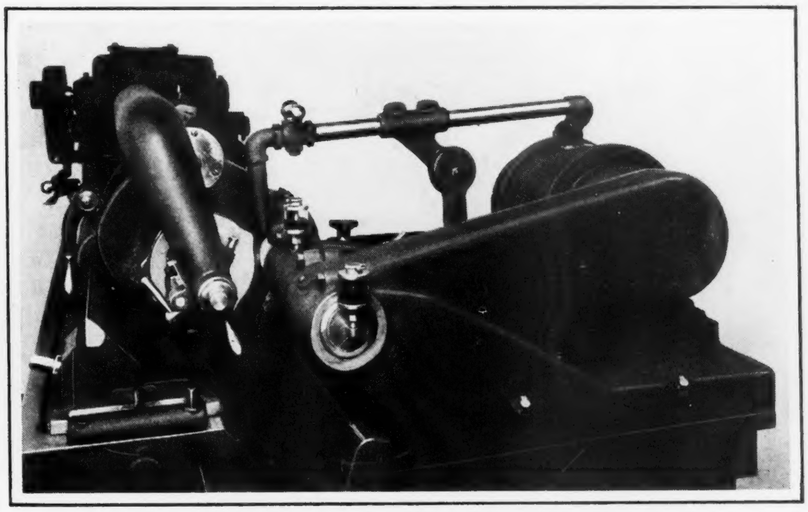
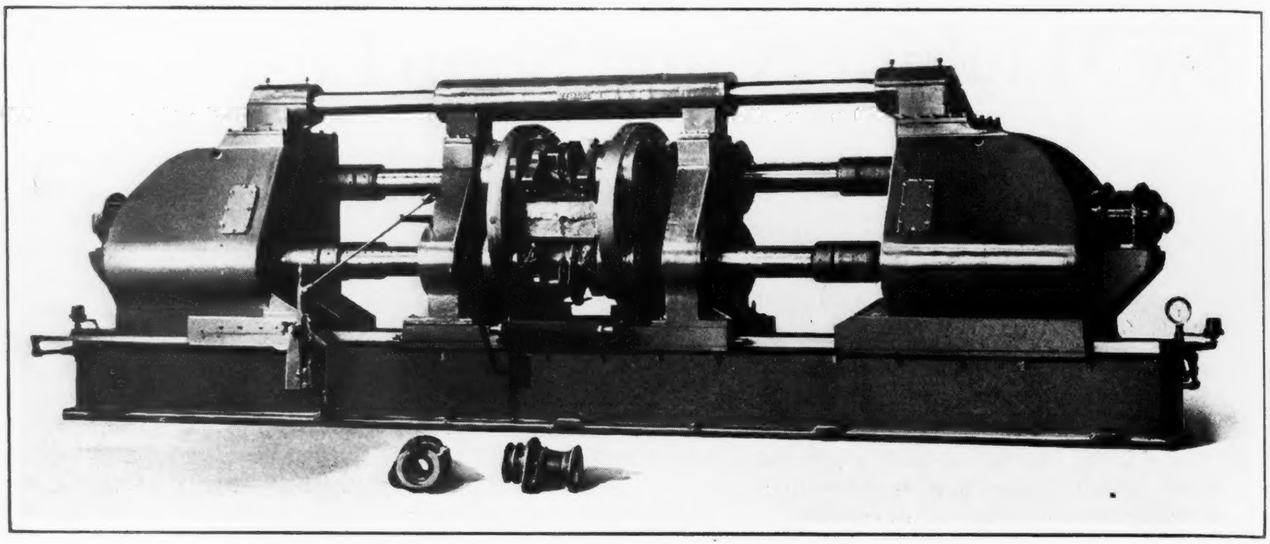


Fig. 2. View Showing the Small-diameter Grinding Wheel in Contact with a Cam



Defiance Two-way Horizontal Boring and Reaming Machine with Oilgear Feed

DEFIANCE HORIZONTAL BORING AND REAMING MACHINE

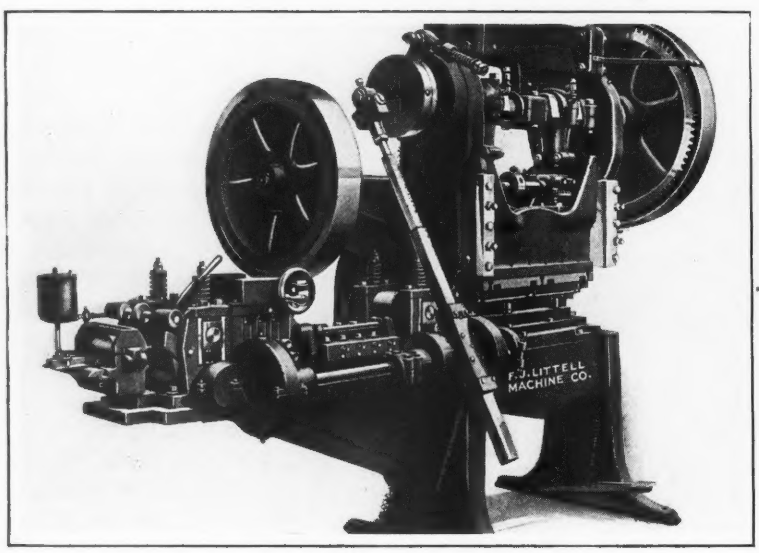
Rear-axle housing carriers for tractors are rough-bored, semi-finish-bored, and reamed at both ends in the special two-way horizontal machine here illustrated. This machine was recently built by the Defiance Machine Works, Defiance, Ohio. Although designed primarily for machining the housing carriers, of which two examples are shown in front of the bed, this equipment may also be employed for similar operations on other parts.

Each head is provided with three spindles which are spaced around a 29-inch circle. The spindles run in Timken tapered roller bearings and are driven by helical gears. The heads are enclosed, and are lubricated by a splash feed system. They are individually driven by 10-horsepower direct-connected motors running at 1200 revolutions per minute. Boring-bars 7 1/4 inches in diameter are provided, and they are inlaid with hardened steel packing strips which are ground to fit revolving bushings in the guide housing and in the work-holding fixture. An Oilgear feed moves the heads to and from the work at rates of speed which can be regulated to suit requirements.

The work-holding fixture is cast in one piece, with the exception of the clamps, and is mounted in large-diameter Timken bearings. It is indexed on its axis and may be clamped in four positions. One of these stations is employed for loading and unloading; one, for the rough-boring step; one, for the semi-finish boring step; and the fourth, for the reaming step. Hardened bushings are provided on both sides for guiding the boring-bars, these bushings also revolving in Timken bearings. When loaded, the fixture weighs about 10,000 pounds and yet can be indexed easily with one hand. An endless conveyor under the fixture carries all chips to one side of the machine.

In addition to the motors employed for driving the heads, there is a three-horsepower motor for driving the Oilgear pump, and a 1/4-horsepower motor for driving the conveyor and speed reducer. Production on this machine averages thirty pieces per hour, there being one cycle of operation every two minutes.

Some of the important specifications of the machine are as follows: Height from bed ways to center of fixture, 28 inches; height from ways to lower spindle, 17 3/4 inches; height from ways to upper spindle, 38 1/4 inches; travel of heads, 38 inches; and net weight of machine, 56,530 pounds.

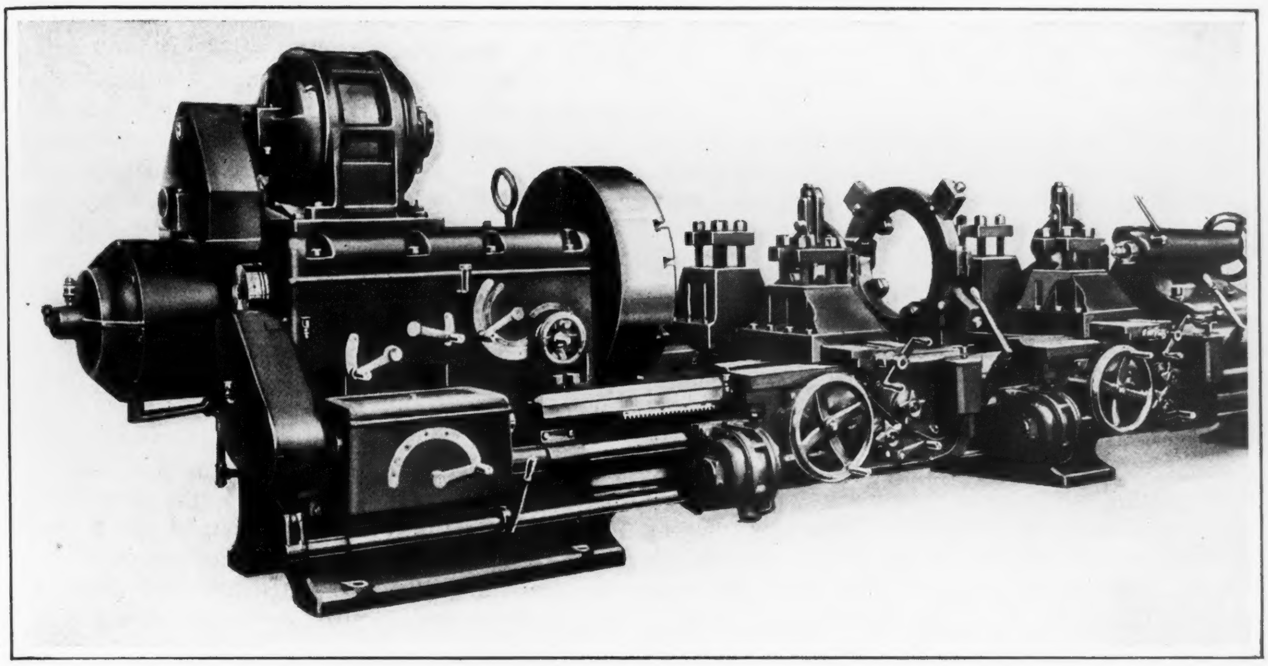


Littell Stock Straightening and Feeding Mechanism

LITTELL PUNCH PRESS FEED

Stock can be fed into punch presses from coils, in lengths up to 36 inches at a time, by means of a No. 5 straightening and feeding mechanism recently developed by the F. J. Littell Machine Co., 4125-4127 Ravenswood Ave., Chicago, Ill. This feed can be made to fit any make of punch press. On the machine here illustrated, the mechanism is adjusted to feed stock 1/8 inch thick, 1 inch wide, and in 33-inch lengths, from coils. The stock is straightened both edgewise and "flatwise" and is oiled on both sides by the mechanism. The machine itself cuts the stock to the desired length and punches a large number of holes in each piece.

The feed rolls are 5 1/2 inches in diameter by 8 1/2 inches long, but they can be made longer if desired. They are hardened



Betts-Bridgeford Lathe for Roughing Operations on Heavy Steel Forgings

and ground. Ordinarily, feeds are mounted on bolster plates, but in this instance, it is mounted on a heavy semi-steel bracket attached to the side of the press. Operating at about thirty-five strokes per minute, this machine produces approximately 15,000 pieces of work in a nine-hour shift.

BETTS-BRIDGEFORD ROUGHING LATHE

The heavy roughing or forge lathe here illustrated has recently been built by the Consolidated Machine Tool Corporation, Rochester, N. Y., for the rapid rough-turning of heavy steel forgings. It has a swing of 36 inches, but the same features of design can be furnished in lathes of larger or smaller swing.

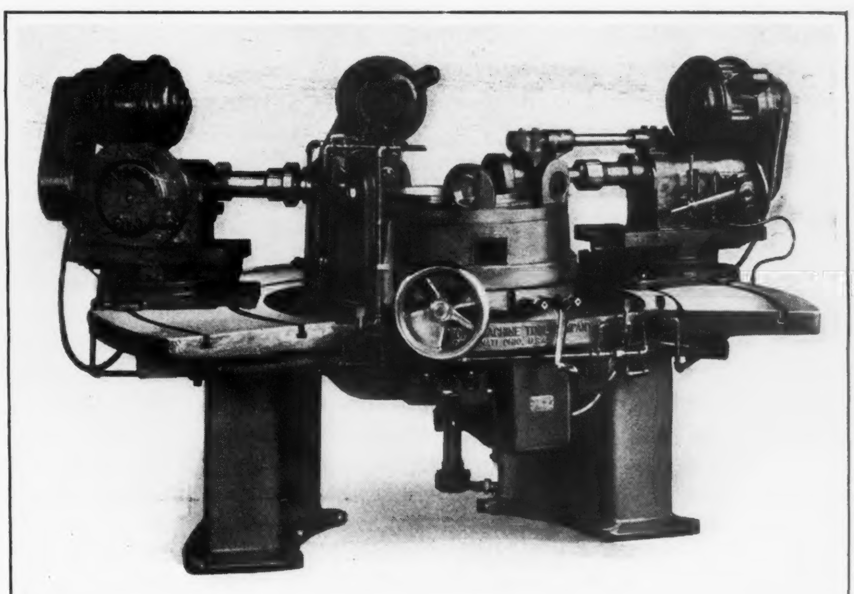
Power is furnished by a 40-horsepower motor, which drives through gearing that gives nine mechanical speed changes. Six of these speeds are available through the steel internal faceplate gear and the steel faceplate. A disk clutch incorporated in the drive is controlled from both carriages for starting and stopping the machine. Four feed changes are obtainable through the medium of sliding gears which run in oil.

The two carriages of this lathe are each equipped with independent front and rear tool-rests of unusually heavy construction. These tool-rests have square guides instead of the usual dovetail type, and are held in position by heavy gibs. They can be adjusted independently either by hand or power. Independent power rapid traverse of the two carriages is available by means of small motors mounted on the aprons. Power feed and rapid traverse are also provided for the cross-slides.

The carriages have a rack feed actuated by a heavy splined shaft, no lead-screw being employed, as the machine is not intended for cutting threads. The steadyrests and the follower-rests are equipped with roller-type jaws instead of the usual stationary jaws.

BRADFORD AIRPLANE-ENGINE CRANKCASE BORING AND TAPPING MACHINE

A three-way drilling and tapping machine has recently been built by the Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio, for rough-boring, finish-boring, and tapping the exhaust ports in the crankcases of Wright "Whirlwind" aviation engines. This machine is equipped with a work-holding fixture provided with a triple index control, and each boring and tapping unit is arranged on a swivel-type mounting block to permit the necessary adjustments required in machining crankcases for five-, seven- and nine-cylinder engines on the same machine.



Bradford Machine for Boring and Tapping Exhaust Ports of Airplane Engines

Each unit is controlled independently from the hand-valves at the front of the machine. Unit No. 1, at the right of the operator, rough-bores the exhaust ports to a maximum diameter of 2.274 inches by using multi-diameter boring tools; unit No. 2, at the back of the machine, finish-bores the ports to a maximum diameter of 2.290 inches, also employing multi-diameter boring tools; and unit No. 3, at the left of the operator, taps a 2 3/8-inch thread in the ports. The crankcases are made from a nickel-aluminum alloy.

In the operation of this machine, after a crankcase has been locked in the fixture, the operator trips the hand-valve at his left to cause unit No. 1 to operate. When this step has been finished, the fixture is indexed to the next station and the operator trips the hand-valves that control units Nos. 1 and 2, causing them to perform the rough-boring and finish-boring operations together. The fixture is then indexed to the third station, and the operator trips the three hand-valves to operate all units for rough-boring, finish-boring, and tapping. The operation is continued until all exhaust ports have been finished.

A duplex system provides for the distribution of cutting lubricants, kerosene being supplied to the boring tools and lard oil to the taps. The floor-to-floor time in handling five-cylinder crankcases is four minutes; seven-cylinder crankcases, five minutes; and nine-cylinder crankcases, six minutes.

CINCINNATI HEAVY-DUTY GRINDING MACHINE

Shafts up to 28 feet long can be handled in a new heavy-duty grinding machine now being announced to the trade by Cincinnati Grinders, Inc., Cincinnati, Ohio. However, in the shop for which this machine was primarily built, there is not more than 300 hours of work of this character in the course of a year. The work handled during the remaining period of each year requires a machine not exceeding 14 feet in capacity between centers. For this reason, the machine was designed to be equally efficient on both classes of work. The problem was solved by providing a 61-foot bed on which were mounted duplex tables having a maximum length capacity of 28 feet between centers. In general appearance, the machine resembles the Cincinnati 14- and 16-inch plain self-contained grinders.

With the duplex table design, the tables may be uncoupled and the short table positioned at one end of the bed. One or both tables can be used continuously or intermittently without loss of accuracy in the bed due to localized wear. This feature is made practical by means of the forced-feed system which oils the table ways. With this system, correct lubricating conditions between the table and its ways are insured, whether the machine is being employed on long or short strokes. The work headstock or tailstock, as the case may be, can be transferred to the table to be used.

The machine is driven by a 30-horsepower alternating-current motor, mounted on one side, which delivers power to a jack-shaft mounted on anti-friction bearings. This location of the motor, together with the flexible coupling between the motor shaft and the jack-shaft, provides accessibility of the drive and eliminates the transmission of motor vibrations to the machine. There is a Texrope drive from the jack-shaft to the grinding-wheel spindle.

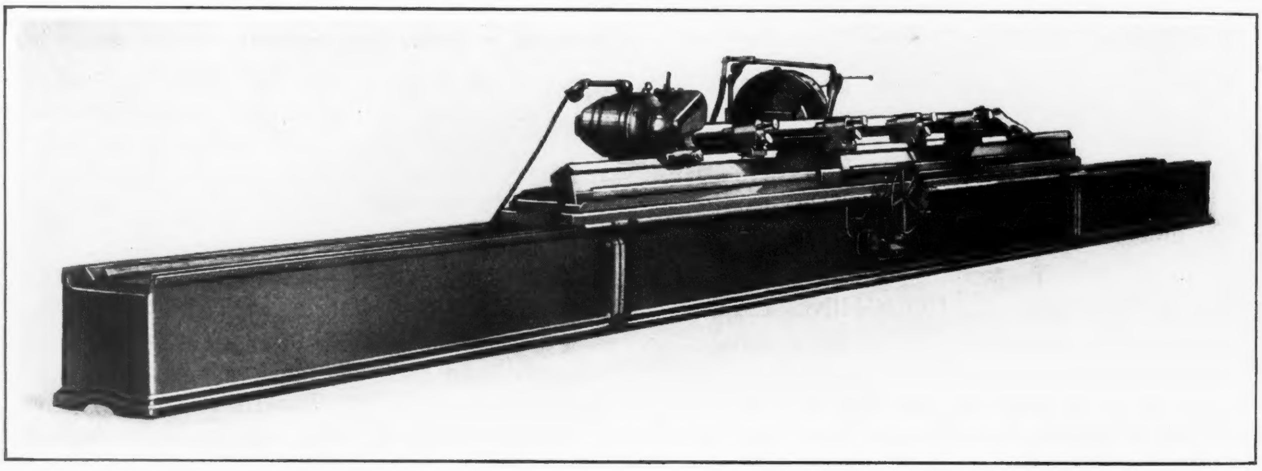


Fig. 1. Cincinnati Heavy-duty Grinder with Duplex Table which can be Uncoupled for Short-bar Grinding

The grinding wheel is 36 inches in diameter and has a 4-inch face. With a wheel of this size, 36-inch diameter work can be ground. The wheel is mounted on a spindle carried on ball bearings on which an initial load is imposed to insure positive contact of all balls with their respective races, and thus prevent any radial or axial play. Moreover, the load is applied in such a manner that spindle expansion would relieve rather than increase it. The intermediate ball bearing is self-adjusting through a force of approximately 800 pounds, which is produced by helical springs. In this manner, there is automatic compensation for wear. The spindle is arranged for Alemite-Zerk lubrication.

The base of this machine is subdivided into two units, front and rear. The front unit is made up of three sections to facilitate transportation, the top section having a vee and a flat way for the sliding table. The vee way is located close to the grinding wheel so as to offer good resistance to grinding forces. The rear base forms a housing for the jack-shaft, for a centrifugal pump having a capacity for delivering approximately thirty-five gallons of coolant per minute, for part of the cross-

feed mechanism, and for a power rapid traverse unit for the wheel-head. This power rapid traverse for the wheel-head is driven by a 1/2-horsepower alternating-current motor, and is supplied on demand. It is controlled by means of a single lever. Both the power and hand traverse are automatically disengaged when not in use.

The headstock is driven by a three-horsepower direct-current variable-speed motor through a Texrope drive and worm-gearing. Back-gears provide additional means for varying the work speed. This motor is mounted on the headstock with its axis perpendicular to the axis of the work. Current is supplied to the motor through wires on an automatic winding drum located at the back of the base. Direct current, if not available, is supplied to the headstock motor by a generator driven by the main motor.

The swivel tables are of the angular type, and are clamped at each end to the sliding table. Taper work up to 14 feet long can be ground on the swivel table without throwing the headstock or the footstock centers out of alignment. The sliding table receives motion through a rack and pinion mechanism and worm-gearing. A "tarry" clutch functions at each reversal of the table to eliminate shocks and decrease stresses in the pinion. Hand-traverse of the table is also provided for. All of the controlling levers of the machine can be conveniently reached from the normal position of the operator.

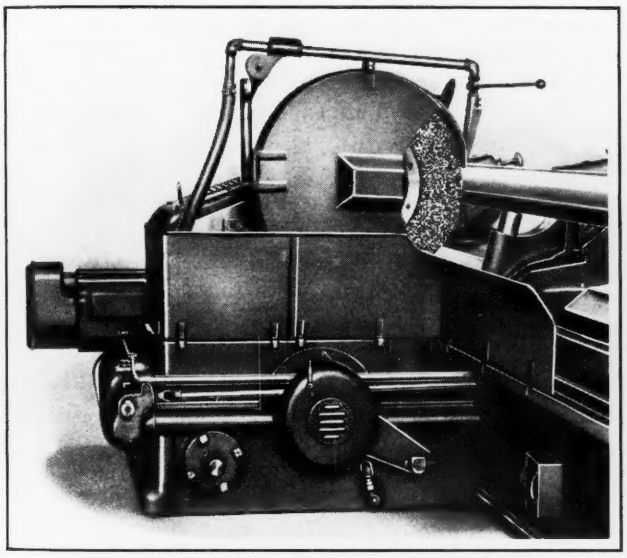


Fig. 2. View of Grinding Wheel and Drive to Coolant Pump

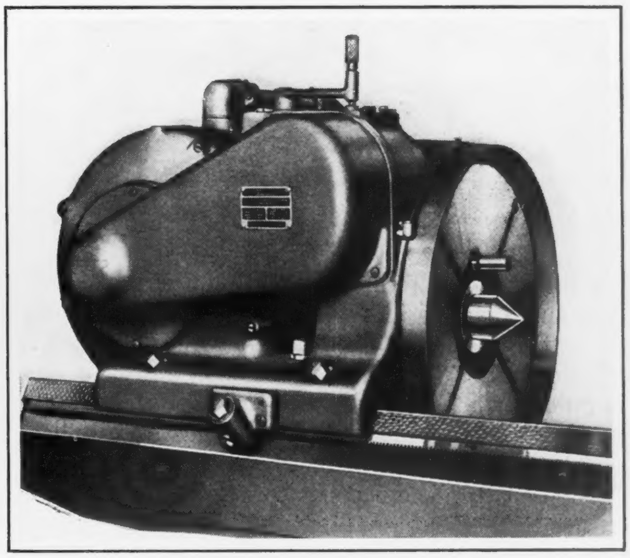


Fig. 3. Self-contained Headstock with Axis of Motor at Right Angles to the Work Axis

CARBORUNDUM FINISHING COMPOUNDS

With the idea of establishing proper standards for the abrasives used in lapping and finishing metals, The Carborundum Co., Niagara Falls, N. Y., has introduced what are known as the "Carborundum Brand Finishing Compounds" in various grades to meet all conditions of lapping and finishing. The abrasive grains used in these compounds are accurately graded to size. The carrier medium used as the vehicle in these compounds is not simply an oil, grease, or water mixture, but is a special composition incorporating the advantages of all three of these. The object in view has been to provide a carrier medium that will not be affected by temperature changes; that will hold the abrasive grain in suspension under all conditions; hold the grain uniformly separated; allow quick cutting action and still prevent deep grain marks; provide for a cool cutting action; be non-flowing, non-dripping, and non-corrosive; that will not be harmful to the operator's skin; and that will not require the use of an explosive cleaner.

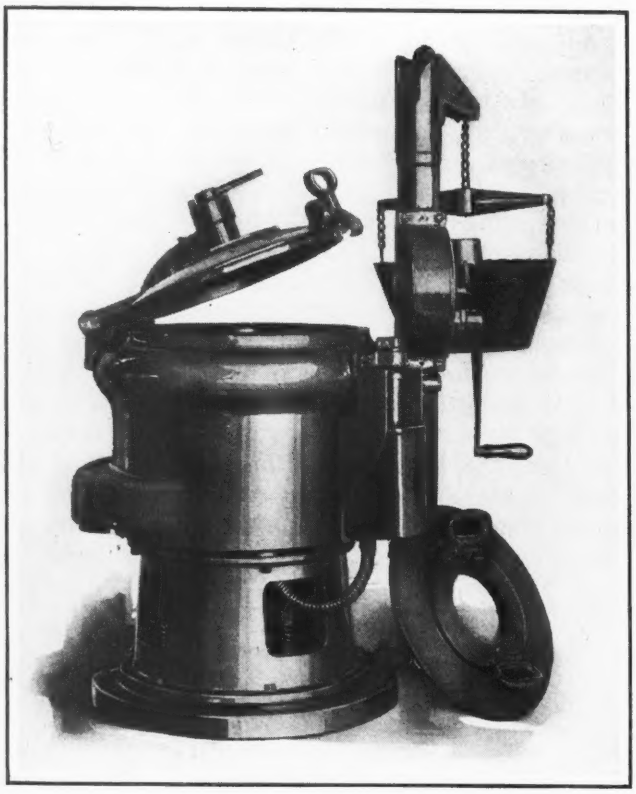
These finishing compounds are made in many different grades in various grits, from extra coarse to extra fine. The compound is made in both paste and fluid form to meet the requirements of the user. The company is in a position to recommend the grade of abrasive and character of compound required for different lapping and finishing operations.

BARRETT CENTRIFUGAL OIL EXTRACTOR, WASHER AND DRYER

The line of self-contained motor-driven centrifugal machines for extracting oil from chips and for washing and drying machine parts, built by the Leon J. Barrett Co., 1475 Grafton St., Worcester, Mass., has been redesigned and another size added. The line now comprises three sizes as follows: No. 252, having a pan diameter of approximately 18 inches and a capacity of 1440 cubic inches; No. 502, pan diameter, 23 inches and capacity, 3720 cubic inches; and No. 1200, pan diameter, 30 inches and capacity, 7500 cubic inches.

As compared with the earlier machines, the motor unit has been redesigned and provided with a ventilating fan which keeps the motor cool under all conditions. The motor unit is built by the Barrett Co. except for the rotor and stator, which are supplied by a motor manufacturer. Motors are available at different speeds to suit the work. By varying the speed, sufficient centrifugal force for the purpose required is obtained, as predetermined by laboratory tests.

Two spindle constructions are now made. The new design is so arranged that a bowl is fixed to



Barrett Improved Self-contained Oil Extractor, Washer, and Dryer

the end of the spindle, providing for a variety of comparatively light plain or perforated containers to fit directly into the fixed bowl. The pans are provided with two lifting hooks, and are easily handled by a hoist. A quick-acting light cover has been provided, which is easily locked and unlocked, and held positively in the locked position. A suitable hoist has been designed for all types of machines to facilitate loading and unloading. For the larger sizes, on very heavy loads, a hydraulic or air-operated hoist may be supplied. The machines are regularly furnished without the hoist, but they are arranged to be fitted with one.

The starting switch and safety locking arrangement are improved, relocated, and so interlocked that the machine cannot be started unless the lid is closed and locked, nor can the lid be opened without stopping the machine, cutting off the current, and unlocking the lid.

A rack is provided on the side of the machine for the cover, and as a whole, the design provides for convenient and speedy operation. The suspension of the rotating unit has been rearranged with an adjustable feature through a carefully calculated balanced mass of metal which absorbs all the vibration.

The machine may be used for extracting oil from chips, for washing machine parts, for drying machine parts, or as a combined washer or dryer. It may also be used for enameling, lacquering, painting, or coating metal parts, and for numerous other operations where centrifugal action can be applied.

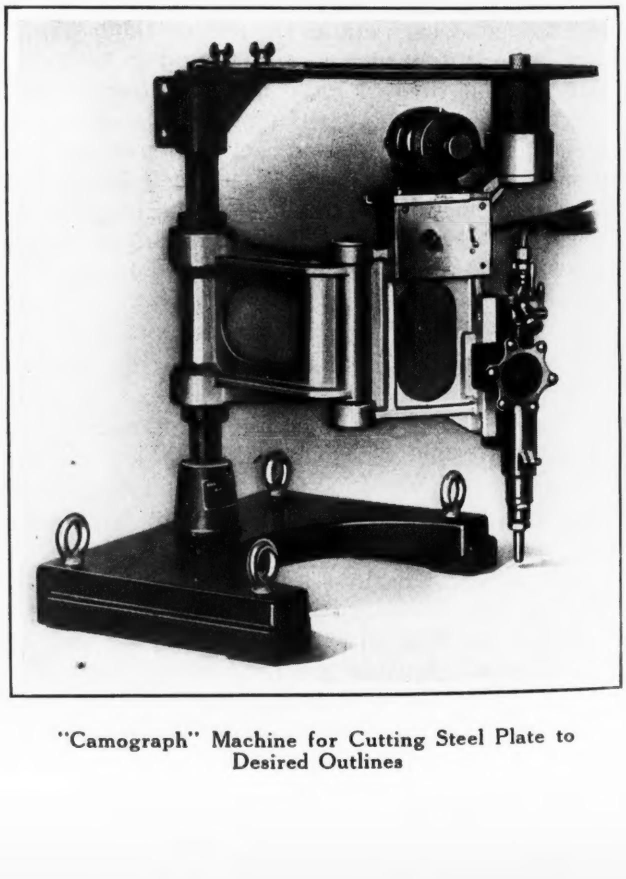
AIRCO-DAVIS-BOURNONVILLE "CAMOGRAPH"

Steel plates can be readily cut to shapes required in building machines, structures, locomotive valve-gear parts, etc., by means of a No. 4 "Camograph" placed on the market by the Air Reduction Sales Co., 342 Madison Ave., New York City. On this machine, an oxy-acetylene cutting torch is mechanically supported and traversed over the work, being guided positively to produce the desired shapes. This machine represents an improvement over the previous No. 2 "Camograph" described in October, 1919, MACHINERY, in that it covers a larger cutting area and has greater flexibility for both curved-form and straight cutting.

The machine comprises a U-shaped base measuring 13 by 20 inches, in which there is fixed a vertical steel post. The moving parts are pivoted on this post, and the post also supports a cam-holder at the top. The mechanism includes two hinged aluminum arms mounted on Fafnir ball bearings, and a hand-operated vertical slide on the end of the outer arm which carries a machine cutting torch. A motor, switch box, gearing and electromagnet are also mounted on the outer hinged arm.

The magnet core is a vertical steel roller driven through reducing gears by the motor. The upper end of the roller is knurled. This roller, strongly attracted to the cam surface when energized by the magnet, carries the hinged arms and cutting torch with it as it slowly rotates and traverses the cam shape by virtue of the traction afforded. The torch directly beneath the roller describes the same path and cuts the desired form from the steel plate beneath its tip. Cams of different types can be quickly substituted for service.

The machine base has an arch beneath the post that admits a section, 7/8 inch by 16 inches, and thus provides for feeding stock plate from the rear when cutting would be facilitated by so doing. The cutting speed of this equipment is varied from 2 1/2 to 28 inches per minute by means of a motor governor. Some of the important specifications of this equipment are as follows: Maximum vertical movement of slide and torch, 5 inches; maximum



"Camograph" Machine for Cutting Steel Plate to Desired Outlines

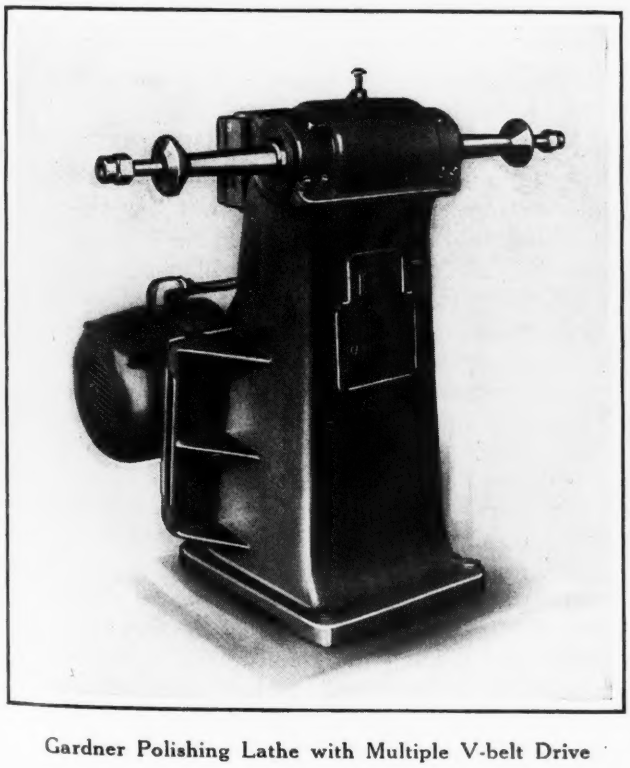
reach, 18 inches; largest segment that can be cut in back of post, 13 by 33 inches; and weight of equipment complete, 150 pounds.

GARDNER POLISHING LATHE

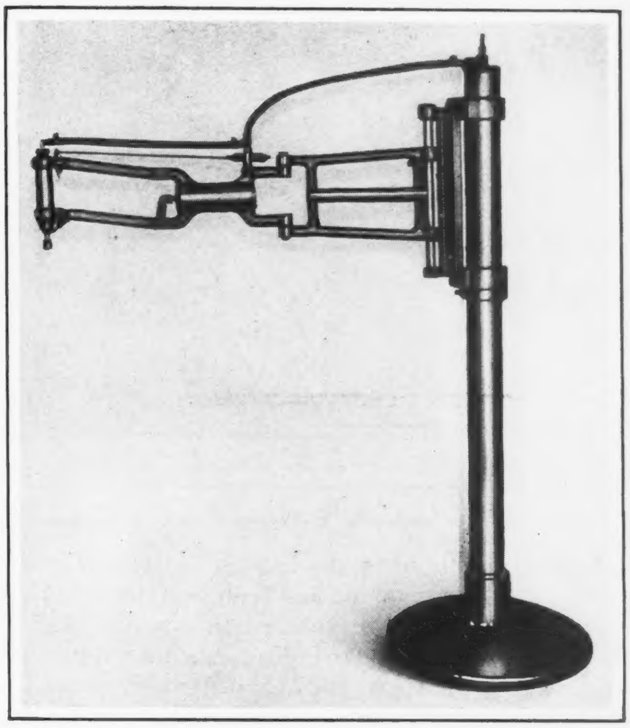
Any desired spindle speed can be obtained on the alternating-current motor-driven No. 3-CB single-spindle polishing lathe now being introduced to the trade by the Gardner Machine Co., 414 E. Gardner St., Beloit, Wis. The spindle of this machine is driven through V-type multiple belts by a motor which is mounted on a bracket cast integral with the machine base. It is by using sheaves of proper diameter that any desired spindle speed can be obtained; this is of considerable advantage where alternating current only is available or is preferred. Belt lengths can be easily varied by means of an adjustment. In case of belt breakage, replacement can be made in a few minutes without disturbing the bearing mounting on the spindle. Belts and sheaves are completely enclosed. The motor is of the enclosed fan-cooled ball-bearing type, and can be supplied in 5-, 7 1/2- and 10-horsepower sizes.

The spindle measures 2 1/4 inches in diameter in the bearings, has an arbor diameter of 1 1/4 inches, and takes polishing wheels up to 3 1/2 inches thick. A Timken double-row adjustable bearing is used at each end. Both of these bearings are mounted in dustproof cartridge housings, which may be removed from the base without disturbing the bearing mounting on the spindle. The entire spindle assembly can be removed as a unit.

The semi-projecting type of base gives a slight overhang of the spindle, and thus provides clearance across the front of the machine for long work. Standard features of other machines built by the company, such as safety spindle nuts, double-capped oil-holes, a handy push-button control station, and a convenient spindle locking device, are also incorporated in this new machine.



Gardner Polishing Lathe with Multiple V-belt Drive



"Air-Flex" Bracket Equipment for Riveting, Chiseling, Drilling, Nut-setting, etc.

"AIR-FLEX" RIVETING AND ASSEMBLING HAMMER

Riveting, calking, chiseling, assembling, and various other operations are facilitated by the "Air-Flex" hammer here illustrated, which is a recent product of Q-C Engineering & Tool Sales, Inc., 7 East Grand Ave., Detroit, Mich. This mechanism is attached to a bracket, which may be mounted on a post or wall, or on a pipe stand as shown. By means of the flexible arm, the tool can be brought to any point on work within a radius of 42 inches and over an area of 180 degrees.

The power feed mechanism for the hammer is especially flexible, as the force of the blow can be varied readily from zero to the maximum amount. This control is independent of the hammer adjustment, but one throttle valve governs both. In operation, when the valve is set for the power feed, the first down movement of the hammer opens the valve to introduce air into the cylinder, and rapidly but smoothly forces the tool to the work. Then when the trigger is depressed, power is applied to the tool.

Three sizes of this equipment are built for driving iron rivets cold up to 5/32, 1/4, and 3/8 inch at the rate of 4000, 3500, and 3000 blows per minute, respectively.

When the "Air-Flex" bracket is equipped with air rotors or electric drills, such operations as drilling, tapping, polishing, screwdriving, reaming, grinding, nut-setting and stud-setting, can be performed.

LANDIS IMPROVED HYDRAULIC CRANKPIN GRINDING MACHINE

An improved hydraulically operated machine designed for grinding all the pins of crankshafts with one placing of the work in the machine, has recent-

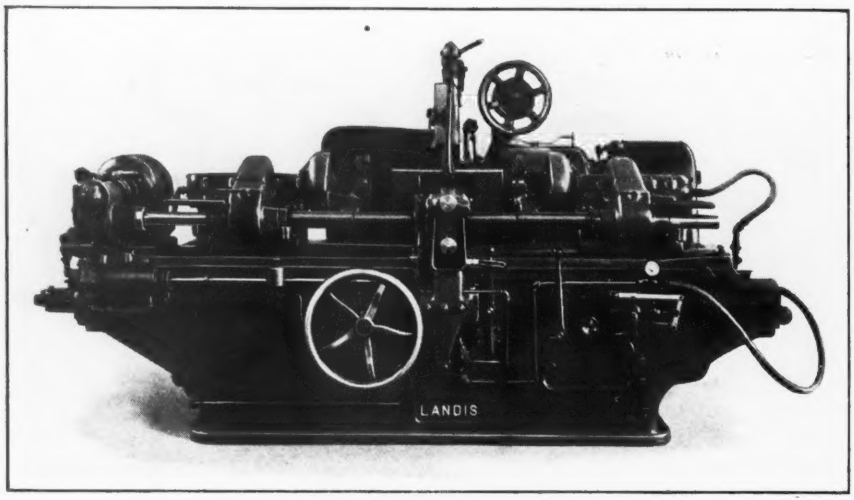


Fig. 1. Landis Hydraulic Crankpin Grinding Machine of Improved Design

ly been brought out by the Landis Tool Co., Waynesboro, Pa. This machine has been designated as the type AB, because the front portion is like that of the type A crankpin grinding machine described on page 617 of April, 1927, MACHINERY, while the rear portion is similar to that of the type B plain grinding machine.

Important improvements include a hydraulic work-rest of much heavier design than on the previous machine; a dynamic brake which has been provided to stop the rotation of the work quickly; and a hydraulic cushioning device for the spacing bar. The work-table traversing lever is so hooked up with the hydraulic work-rest that the work-rest jaws will always withdraw before the table starts to traverse. This arrangement makes it impossible to bump the cheeks of the crankshaft against the work-rest jaws in case the operator forgets to withdraw the jaws before traversing the carriage.

At the rear, the new machine differs greatly from the type A machine. In the first place, there is an end drive to the grinding-wheel spindle by means of multiple V-belts, whereas on the former machine, a flat leather belt was employed to deliver power to the spindle between the bearings. Special babbitt steel-back wheel-spindle bearings are used instead of bronze bearings, as on the previous machine. This feature is particularly advantageous in that the babbitt steel-back bearings can be adjusted much closer than the bronze bearings, and this insures a much better finish on the work.

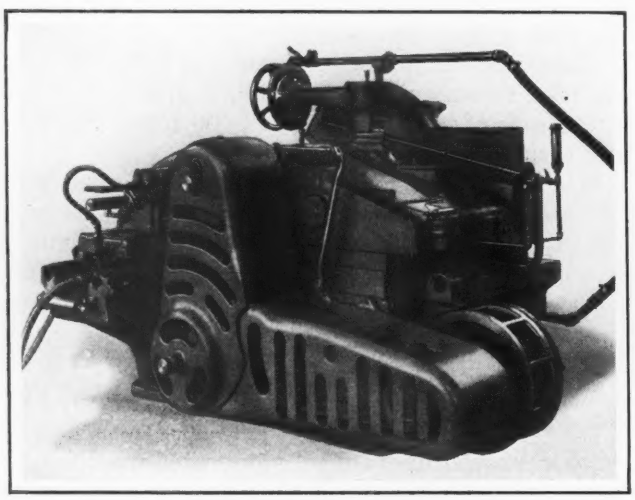
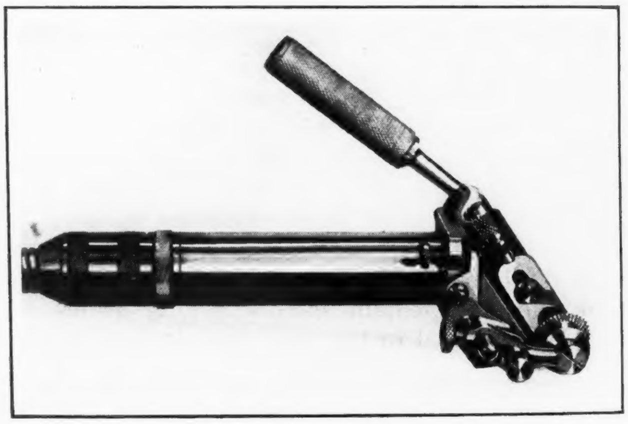


Fig. 2. View Showing the Multiple V-belt Drive

On the previous type A crankpin grinding machine, the hydraulic in-feed was actuated by a small motor at the right-hand side of the base, whereas on the type AB machine, this action is obtained through a piston located underneath the base. On the previous machine, the oil-pump was driven by means of a silent chain from the rear drive shaft; on the improved machine, the same multiple V-belts that drive the grinding-wheel spindle, drive the oil-pump. The oil-pump shaft extends into the rear portion of the bed where it is coupled to the water-pump shaft. Thus, the water pump is driven without additional belts, chains, etc.

This type AB machine is available in the 16- by 32-inch and 16- by 42-inch sizes. It is equipped with a 36-inch diameter grinding wheel. The main driving motor is of 25-horsepower rating, and is mounted on the rear of the machine with its pulley directly in line with the pulleys of the wheel-spindle and the traverse oil-pump. A lineshaft drive can also be provided for.



Mica Under-cutter made by the Ideal Commutator Dresser Co.

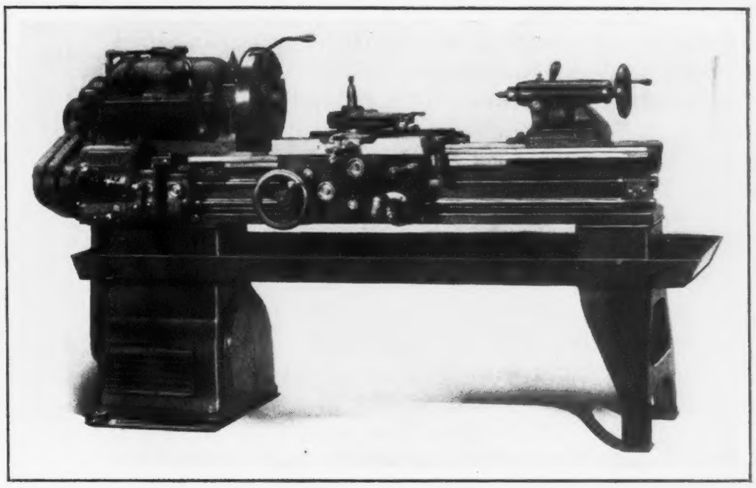
MOTOR-DRIVEN MICA UNDER-CUTTER

The advantages claimed for a motor-driven mica under-cutter recently brought out by the Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill., are that the device will not heat, jump, or chatter. It can be operated in a space 3 1/2 inches wide, and thus no time need be spent in dismantling brushes, brush-boxes, brush rigging, etc., prior to using, or in reassembling parts before putting a machine back into service.

This mica under-cutter is equipped with an adjustable depth gage having a set-screw lock. There is a micrometer adjusting screw for raising and lowering the depth gage as desired. Another micrometer adjusting screw provides for setting the roller guide the proper distance from the cutter, while a third micrometer adjusting screw permits raising or lowering the roller guide to conform to the size or diameter of cutter used. The roller guide is locked in place by means of a set-screw.

Easy replacement of cutters is facilitated by ro-

tating the entire roller-guide assembly. The roller guide rotates when the undercutter is moved. The cutter or saw is held in place by means of two lock-nuts, one on each side. The depth gage is located next to the saw, so that the depth can be instantly measured.

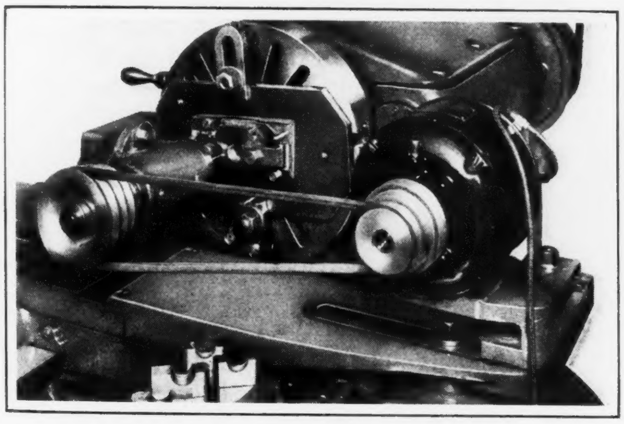


Rockford Quick-change Geared-head Lathe

INTERNAL THREAD MILLING ATTACHMENT

The internal thread milling attachment here illustrated has been designed primarily for milling fine threads in inserts for die-casting dies employed in the manufacture of washing-machine water connections. This thread milling attachment was developed by N. Lester of the P & R Tool Co., Worcester, Mass., Division of the Precision Castings Co., Inc., Syracuse, N. Y. It is manufactured by the Reed-Prentice Corporation, Worcester, Mass. The lead of the thread on the work is obtained by employing the lead-screw of the engine lathe on which the attachment is mounted.

The main spindle is mounted on Timken tapered roller bearings which take both radial and thrust loads. Spindle speeds range from 500 to 1500 revolutions per minute. The cutter is of the standard circular design. A micrometer stop located on the lathe bed governs the depth of the thread being cut.



Special Motor-driven Internal Thread Milling Attachment Mounted on Lathe

ROCKFORD GEARED-HEAD LATHES

Completely redesigned geared-head engine lathes are being placed on the market by the Rockford Machine Tool Co., 2400 Kishwaukee Road, Rockford, Ill., in 12-, 14-, and 16-inch sizes, under the trade name of "Economy." Timken tapered roller bearings are provided throughout the headstock of these machines, with the exception of the spindle bearings in the 12- and 14-inch sizes, these bearings being made of bronze. The headstock of the 16-inch lathe, however, is equipped with Timken bearings throughout.

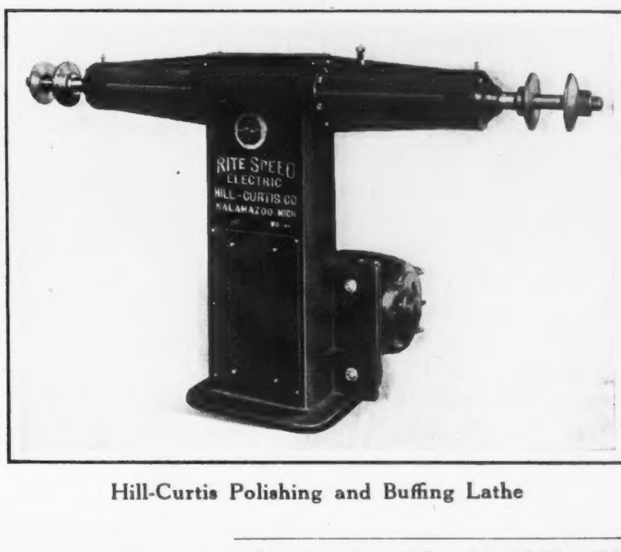
Twelve spindle speeds are obtainable in geometrical progression by means of gears which run constantly in oil. Power is transmitted to the machine through a "Twin Disc" clutch. A brake is furnished for stopping the spindle instantly. When the machine is motor-driven, the motor is installed in the compartment contained in the leg at the headstock end of the lathe. From the motor to the headstock, the power is transmitted by endless leather belts. The motor base is pivoted, and an adjustment is furnished for keeping the belt under proper tension. The motor leg is well ventilated, and large covers make the motor readily accessible.

The carriage has long continuous bearings on the bed ways. The apron is of the double-wall type, permitting a double-bearing spindle for all gears. On the 16-inch lathe there is an apron control for the clutch and brake, in addition to the headstock control, but the 12- and 14-inch machines have the headstock control only.

Thirty-two changes of threads and feeds are obtainable through the sliding gears and clutches of the quick-change gear-box. These gears and clutches are controlled by means of the two large convenient handles. Standard threads from 4 to 56 per inch, and feeds corresponding to from 18 to 252 revolutions of the headstock spindle per inch of carriage travel, are available without special gears. The actual swing on these lathes is 13 1/16 inches for the 12-inch size; 14 5/8 inches for the 14-inch size; and 17 3/4 inches for the 16-inch size.

HILL-CURTIS "RITE-SPEED" POLISHING AND BUFFING LATHE

A polishing and buffing lathe designed primarily for buffing automobile fenders, but which is also suitable for a wide range of other work requiring



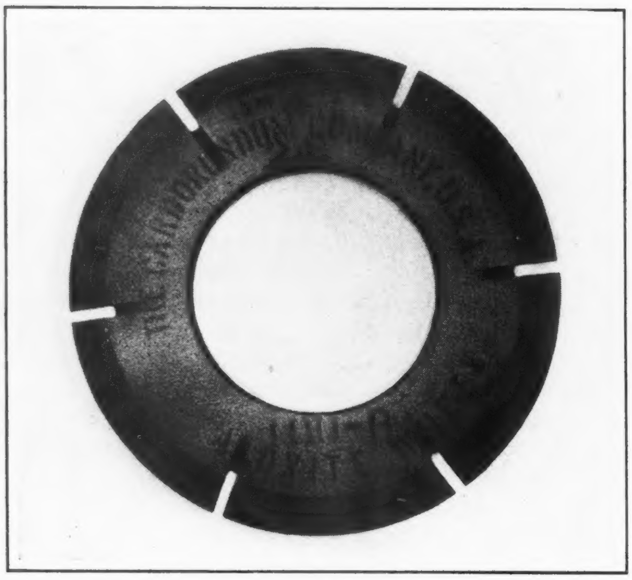
Hill-Curtis Polishing and Buffing Lathe

maximum working room for two operators, is being placed on the market by the Hill-Curtis Co., 1604 Douglass Ave., Kalamazoo, Mich. This machine has a spindle 80 inches long over all, driven through a multiple "Texrope" drive. Any desired spindle speed can be obtained by changing the motor pulleys.

Motors of 3, 5, 7 1/2, 10 and 15 horsepower rating, can be furnished for either alternating or direct current. The motors are designed to withstand momentary overloads of 100 per cent of the rated capacity, and are equipped with the Hill-Curtis air cleaner, which filters all air reaching the motors. On each machine, the motor is mounted on the back of the pedestal where it is conveniently accessible. A push-button remote control with an automatic motor starter and a thermal overload protection, is standard equipment, as well as a spindle lock. Either Timken tapered roller bearings or Fafnir ball bearings can be furnished.

CARBORUNDUM WHEEL FOR SHARPENING SPIRAL-BEVEL CUTTERS

A wheel especially intended for use on the Gleason 12-inch automatic spiral-bevel cutter sharpener for sharpening cutters for spiral-bevel gear roughing and generating machines, has been placed on the market by the Carborundum Co., Niagara Falls, N. Y. This wheel is 14 inches in diameter by 3/4 inch thick, and has a 7-inch hole in it, and a 60-degree beveled edge. There are six grooves or slots spaced at equal distances around the periphery of the wheel.



Carborundum Wheel Designed for Use on Gleason Spiral-bevel Cutter Sharpeners

These wheels are regular equipment for the Gleason spiral-bevel cutter sharpening machines. It is stated that a wheel of this construction will remove stock at twice the rate and with less heating than the wheels formerly used for this purpose. As a grinding compound for use in connection with these wheels, it is recommended that a water coolant be applied, with just enough soda added to keep the machine from rusting. This coolant is delivered directly to the point of contact between the wheel and the work.

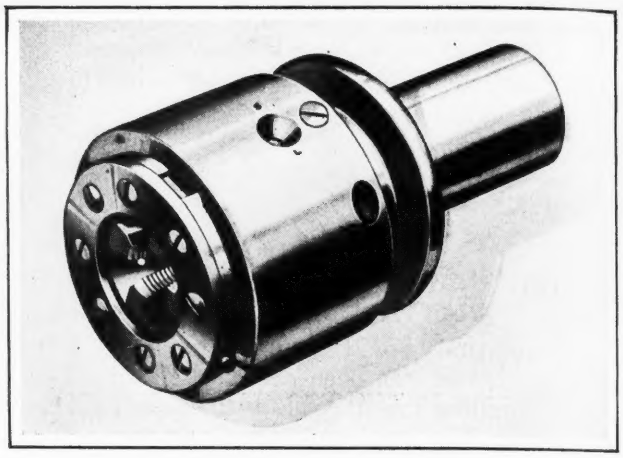


Fig. 1. "Namco" Opening Die with Quick-removable Chasers

"NAMCO" OPENING DIES AND COLLAPSING TAPS

Chasers that can be quickly replaced constitute the principal feature of a line of opening dies and collapsing taps now being placed on the market by the National Acme Co., Cleveland, Ohio. By loosening one screw and pushing back the cup or body of the tool, the chasers are released and they can be taken out with the thumb and finger. A fresh set of chasers can then be slipped into place, and after the body or cup has been snapped back into the retention position and the screw tightened, the device is again ready for threading operations.

During the changing of chasers, the tap or die, as the case may be, can remain set up in the machine. Settings of these threading tools are undisturbed by the insertion of fresh sets of chasers. Speed of changing the chasers is an important advantage.

Die chasers, when in the released condition, are held from dropping out by a brake-shoe arrangement. For cleaning a die, every part is made accessible by merely removing one screw, and there are only three major parts to a die. Fig. 1 shows one of these new "CR" revolving type dies. They are regularly made in five sizes ranging from 7/16 to 1 5/8 inches.

The new taps are made in revolving and stationary types known as "CR" and "CS," respectively, as shown in Figs. 2 and 3. In these taps, there is

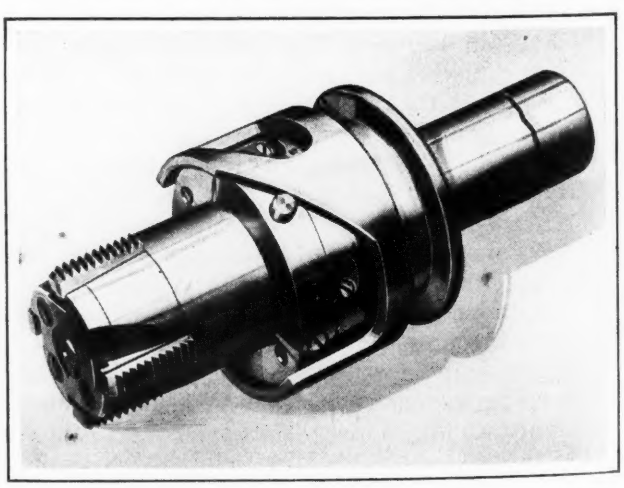


Fig. 2. Collapsing Tap of the Revolving Type

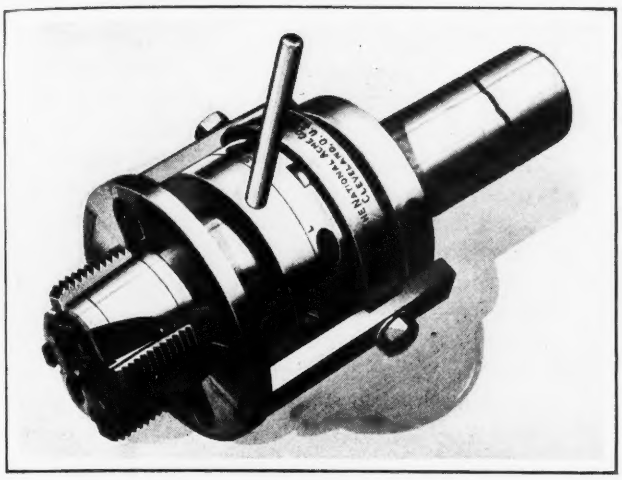


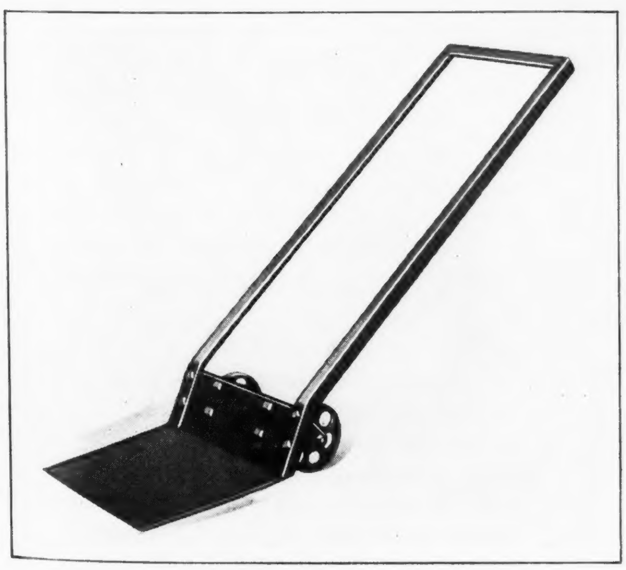
Fig. 3. Stationary Type of Collapsing Tap

a positive cam action for collapsing the chasers. This mechanism also prevents the chasers from tipping, and thereby eliminates tapered threads. Positive adjustment of the chasers is effected by means of two opposed self-locking screws. The design of the taps is such that the chasers do not overhang the core-piece. Fine dust, chip particles, and heavy oil can be readily blown from the taps by compressed air because of the open core-piece and front plate. The taps are made in six sizes, ranging from 2 1/4 to 4 5/8 inches.

POLLARD "PICK-UP" TRUCK

The hand truck here illustrated is designed to permit parts, boxes, etc., to be conveniently picked up and transported. This "Pick-up" truck has recently been added to the line of equipment made by the Pollard Bros. Mfg. Co., Inc., 4034-36 N. Tripp Ave., Chicago, Ill. The truck is simply pushed under the object that is to be transported to some other part of the shop, and then after the handle has been pressed down, the object can be readily trucked away.

The wheels are 6 inches in diameter, have roller bearings, and are mounted on steel forks. Either semi-steel or rubber-tired wheels can be furnished.



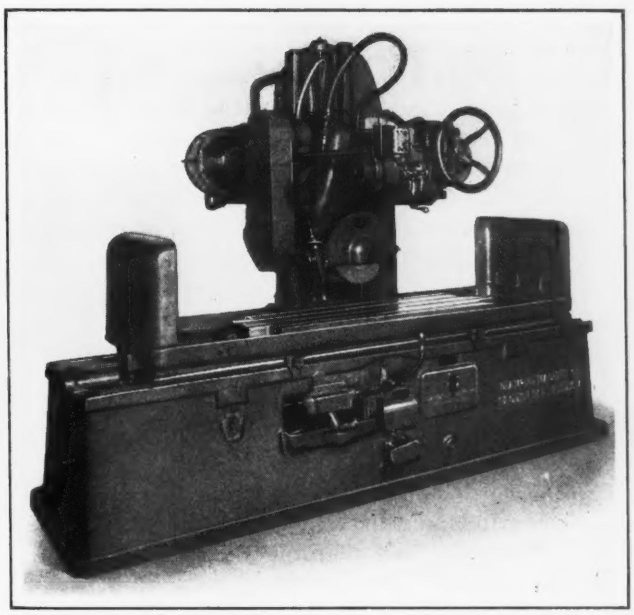
Pollard Hand Truck Designed to Enable Parts to be Easily Picked up

The lifting platform measures 14 by 16 inches, is made of heavy sheet steel, and is beveled at one end. The handle is bent to a comfortable angle for use.

DIAMOND UNIVERSAL-HEAD SURFACE GRINDING MACHINE

Vertical, horizontal, and angular grinding operations can be performed with the type H universal-head surface grinding machine recently developed by the Diamond Machine Co., 9 Codding St., Providence, R. I. The angle of the universal head, which is an integral part of the machine, is changed by simply loosening two clamp screws and turning the wheel to the desired angle. The wheel can be accurately set to a protractor placed on the table, or, if desired, a protractor can be attached to the machine. Wheel guards for disk, cup, and dish abrasive wheels are furnished.

Among other features of the machine is a hydraulic table drive which provides a wide range of speeds that are instantly changed by turning a control valve. Fast table speeds are maintained under heavy loads. The hydraulic table drive, for automatic cross and vertical feeds, and the rapid power traverse, together provide mechanical speed of op-



Diamond Surface Grinding Machine with Universal Head

eration. Centralization of controls makes it possible for the operator to perform all the necessary functions from the front of the machine.

This machine is designed for the usual size of work, but also has capacity for larger work. Standard sizes handle work 16 inches wide, either 48 or 72 inches long, and 12 or 16 inches high, depending upon the wheel used. The bed and table are independent of the head upright and cross-rail. Other features of the machine include a large capacity coolant system, a lubricating system fed from a single reservoir, an accessible drive mechanism, ball-bearing motors, and cast-aluminum end guards.

INSIDE INDICATOR GAGES

Indicator gages intended for use in inspection or production operations where the diameter of holes must be checked are being placed on the market in

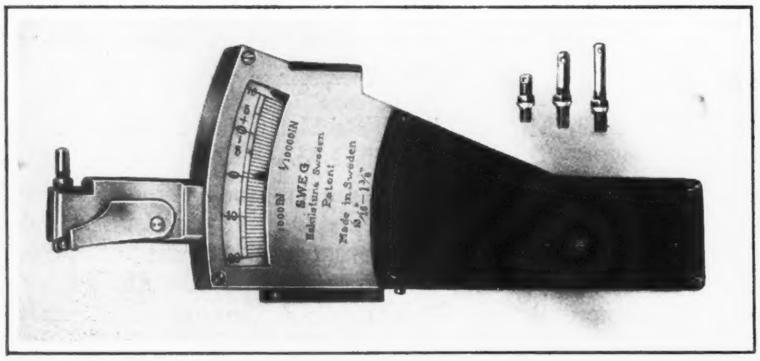


Fig. 1. Internal Indicator Gage Placed on the Market by the Swedish Gage Co. of America

five sizes by the Swedish Gage Co. of America, Stormfeltz-Loveley Building, Woodward Ave. at Grand Blvd., Detroit, Mich. The principal claim made for these gages is that very accurate measurements can be taken within a range near the zero mark, which represents the nominal dimension for which the instrument has been adjusted. This accuracy is made possible through the combined action of two pointers, which move over coarse and fine graduations, a fixed and a movable anvil, and two locating studs which insure correct alignment of the instrument. It is also mentioned that the gages show not only whether the hole being inspected is within the proper limits of accuracy as to diameter, but also whether the hole is a true circle or out of round, bell-mouthed, etc.

The total measuring length of the five gage sizes is from 3/8 to 6 inches on the gages graduated in inches, and from 9 to 150 millimeters on gages graduated according to the metric system. The two smaller sizes of these gages are of the design shown in Fig. 1, while the three larger sizes are of the design illustrated in Fig. 2. It will be seen that the scale of these gages is provided with two zero marks, one for each pointer. One side of the scale having inch graduations is graduated to 0.001 inch, and the other side to 0.0001 inch.

The indicator mechanism is so arranged that the fine-graduation pointer moves ten times as far as the coarse-graduation pointer for the same movement of the anvil. Assuming that the indicator is used for measuring a hole which is being machined, the coarse-graduation pointer will indicate how much stock is to be removed before the correct size is obtained. It will move successively toward the zero mark, indicating, for instance, that 0.016, 0.009, or 0.003 inch of stock must be removed to finish the hole to the prescribed size.

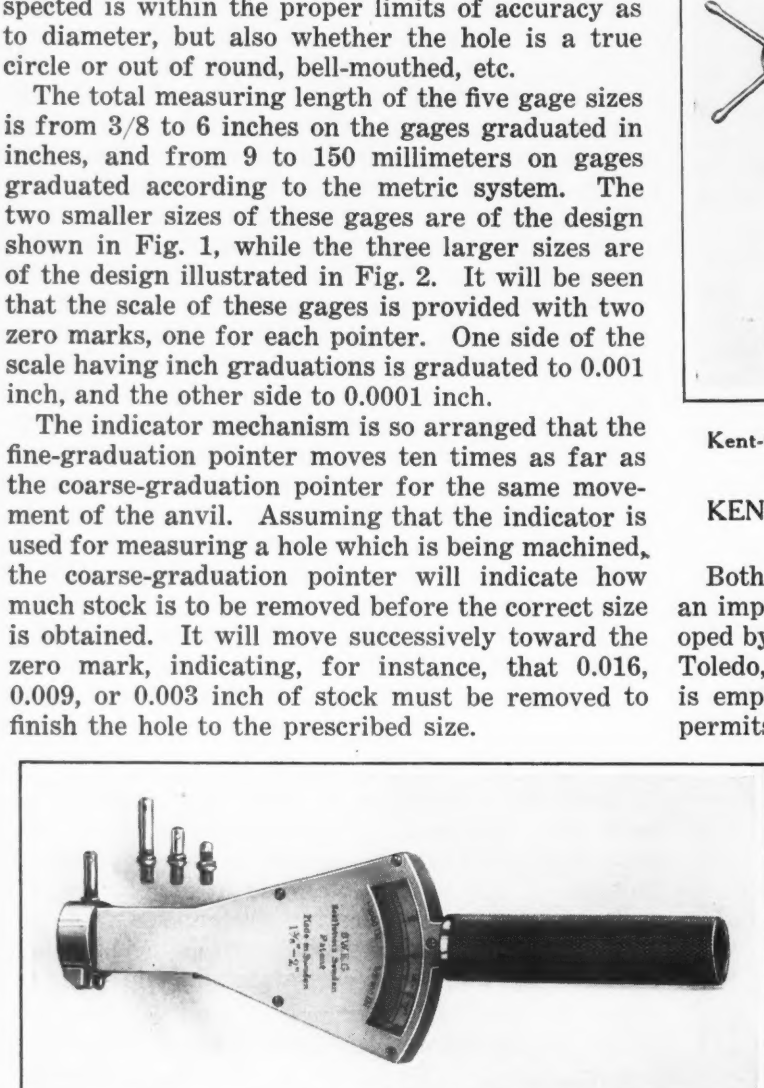
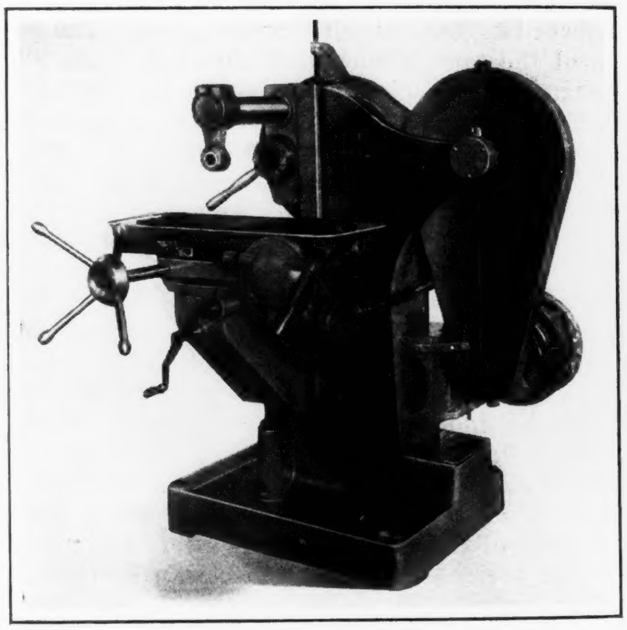


Fig. 2. Indicator Gage of a Larger Size than that Shown in Fig. 1

The fine-graduation pointer will remain at rest immediately to one side of the central zero mark until the coarse-graduation pointer moves through the distance of its last graduation, when the fine-graduation pointer commences to move toward its zero mark. If the diameter of the hole is then further increased, the fine-graduation pointer will move across the zero mark to the graduations marked plus, thus indicating how much excess metal has been removed. The coarse-graduation pointer also continues to move until it reaches a position just past its zero mark, where it becomes disconnected and stops.

These gages can be set to the desired size by means of Ford-Johansson gage-blocks and a pair of jaws assembled in a holder, or by a ring gage of the correct size. The body of these gages is made of cast iron, and all working parts are of tool steel.



Kent-Owens Miller with Both Manual and Power Feeds for the Table

KENT-OWENS COMBINATION HAND- AND POWER-FEED MILLER

Both manual and power feeds are available on an improved No. 2 milling machine recently developed by the Kent-Owens Machine Co., 958 Wall St., Toledo, Ohio. Whether the manual or power feed is employed, the quick return is by hand, which permits a rapid traverse of from 600 to 700 inches per minute. The conveniently located star-wheel is used for both the manual feed and the rapid traverse.

The power feed is operated by means of the lever to the right at the front of the machine. Adjustable trip-dogs on the table automatically engage and disengage this feed. The head may be fed vertically by hand; it is counterbalanced by means of a weight suspended inside the column, which insures smooth and easy operation. Timken tapered roller bearings have been provided for the spindle and back-shaft

bearings to insure the maintenance of accuracy and permit the high speeds desired when using small-diameter cutters, when milling aluminum, brass, and other soft materials, and when using Carboloy or similar tools.

The table is 25 inches long by 14 inches wide over-all, and the maximum distance from the spindle to the top of the table is 17 1/2 inches. The column has a large coolant tank cast integral with it. This machine may be arranged with either a belt or a motor drive, a motor of from three to five horsepower being recommended in the latter case.

ALEMITE DRIVE FITTINGS FOR OPEN OIL-HOLES

Drive fittings intended for assembly in open oil-holes of machinery, shaft hangers, etc., so that all oil-holes in a plant may be lubricated by the Alemite high-pressure system, have been placed on the market by the Alemite Mfg. Corporation, 2678 N. Crawford Ave., Chicago, Ill. These drive fittings are made to suit threadless oil-holes from 1/8 to 1/2 inch in diameter. They are designed to stay in any kind of oil-hole, whether it is round or egg-shaped, countersunk, straight, or drilled at an angle.

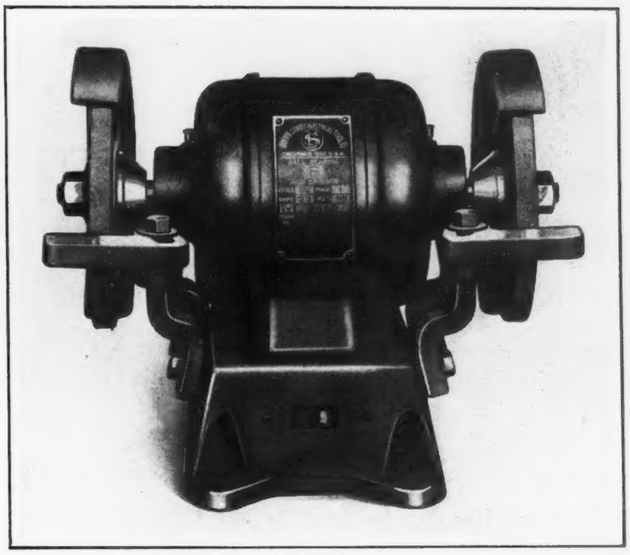
Tool Used to Drive Alemite Fitting Bushing into an Oil-hole

Each of the new fittings has two parts. One is a reverse feather-edged bushing, which is driven into the oil-hole. These bushings come in 1/64-inch sizes, and the proper size for a given hole is determined by a ring gage. After the bushing has been solidly installed in the hole, a standard nipple containing a ball check-valve is driven into the bushing. The special drive tool employed rivets the side of the bushing over the edge of the nipple, so that it cannot escape.

Nipples for all bushings are of the same size, and there are only two types, the straight and the angle. Three types of bushings are made in order to meet all conditions. The standard bushing should be used for nearly all oil-holes, but there is a special bushing for countersunk holes and holes drilled at an angle. The third type of bushing is shorter than the standard, and is intended for use in thin housings to insure that the bushing shank will not strike the shaft.

U. S. SIX-INCH GRINDER

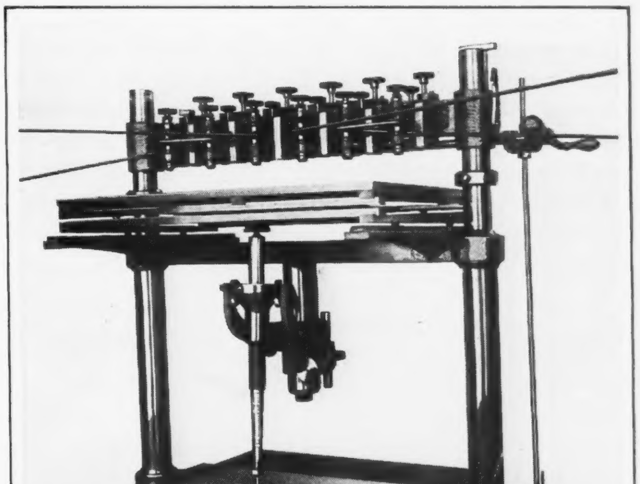
A 6-inch grinder recently introduced to the trade by the United States Electrical Tool Co., Cincinnati, Ohio, is shown in the accompanying illustration. This machine is equipped with ball bearings, a nickel-steel spindle, and a 1/4-horsepower motor which runs at a load speed of 3450 revolutions per minute. The grinder is also provided with fine and coarse wheels of the 6- by 1/2- by 1/2-inch size and adjustable tool-rests. It is furnished regularly for 110-volt, 60-cycle alternating current taken from a light socket. However, it can also be supplied for 220-volt, two- and three-phase alternating current, and for 110- and 220-volt direct current.



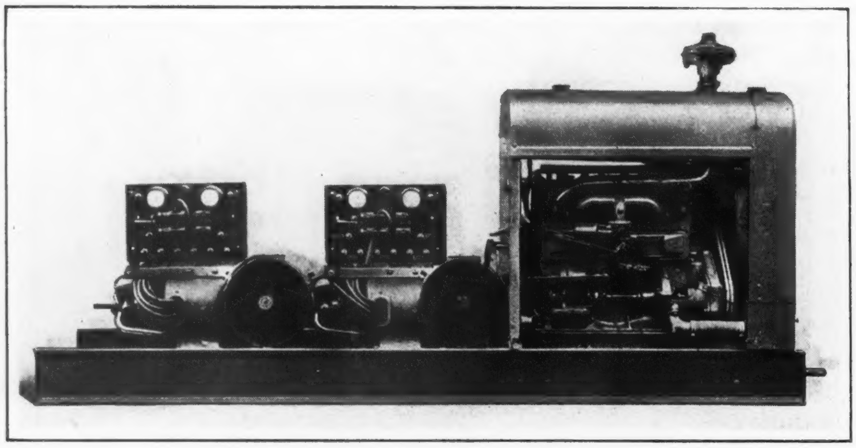
United States Electrical Tool Co.'s Six-inch Grinder

MULTIPLE-SPINDLE ENGRAVING MACHINE

Parts made of steel, brass, copper, celluloid, ivory, bakelite, and other materials can be engraved in multiple with the machine here illustrated, by means of a gang of rapidly revolving cutters. This machine is a recent product of the Engravers & Printers Machinery Co., Sag Harbor, Long Island, N. Y. The particular model shown is used for producing celluloid lettering templets for draftsmen.



Engraving Machine with Twelve High-speed Cutter-spindles



"Dualarc" Two-operator Welding Outfit

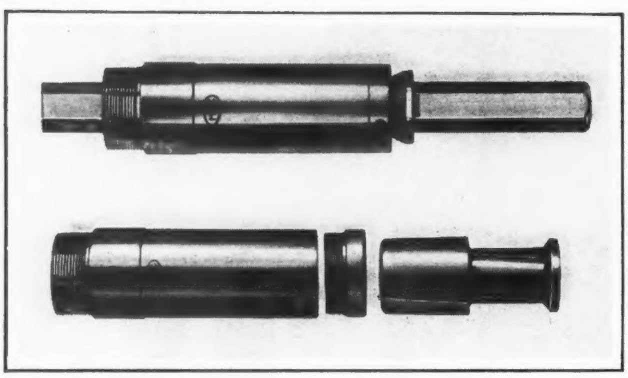
The machine can be quickly set to suit any size of work within its capacity. A novel feature that has been found especially useful is the ability to vary within wide limits the proportions of the letters or patterns produced on work from any given master plate. This machine may be operated by any boy or girl.

H & G FEED-PUSHER FOR AUTOMATIC SCREW MACHINES

A new type of feed-pusher designed for application to multiple-spindle automatic screw machines has recently been brought out by the Eastern Machine Screw Corporation, Truman and Barclay Sts., New Haven, Conn. This device is composed of two principal parts—the master, which fits on the end of the customary feed-rod, and the inner pusher, which is installed inside the master.

A taper on the inside of the master that corresponds with the taper on the inner pusher causes the latter to grip the stock firmly when the feed-tube is pushed forward. When the feed-tube is drawn backward, the inner pusher is released and slides freely over the stock.

After a machine is once equipped with a set of masters, it is only necessary to change the inner pushers when changing from one size of stock to another, the masters remaining as permanent parts of the machine. It is stated that this feed-pusher has a positive grip and positive release, provides a uniform feed, eliminates rebound and obviates drag marks. The uniform feed and elimination of rebound lessen the amount of scrap from short pieces and result in a considerable saving in time because they permit high-speed feeding of stock.



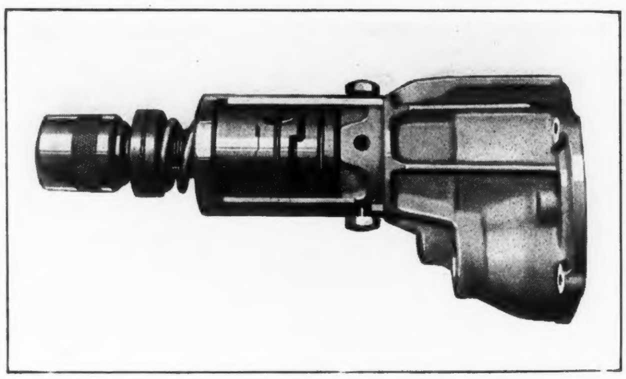
H & G Feed-pusher for Multiple-spindle Automatic Screw Machines

"DUALARC" TWO-OPERATOR WELDING OUTFIT

In a two-arc or two-operator welding outfit recently brought out by the Electric Arc Cutting & Welding Co., 152-156 Jelliff Ave., Newark, N. J., both generators are driven by a 40-horsepower Continental "Red Seal" gasoline engine. The equipment, here illustrated, may be used for either metallic or carbon arc welding. Each generator is of 300-ampere capacity, alternating or direct current. The gasoline consumption in continuous welding is 3/4 gallon per hour, and in continuous compressing, 3/8 gallon per hour. A 10-gallon gasoline tank is provided. The air compressor is mounted on a hinged base, so arranged that it can be conveniently lifted in or out of gear.

"THOR" NUT-DRIVING ATTACHMENT

Uniform tightness in the driving of nuts is the principal claim made for a "Kick-Out" nut-driving attachment with double slip clutch which has recently been added to the line of "Thor" electric tools manufactured by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. The design of this device is such that clutch breakage is prevented and the breaking of studs or stripping of nuts eliminated.



Nut-driving Attachment brought out by the Independent Pneumatic Tool Co.

As may be seen in the illustration, the attachment is provided with an auxiliary clutch which operates under spring tension when a certain torque is applied to the front of the attachment. When a nut is driven to this tension, the auxiliary clutch disengages and lifts itself relative to a cam which permits the front end of the attachment to remain stationary for one revolution before the auxiliary clutch is again engaged. During this time, the operator has ample opportunity to pull the machine away from the nut. A sleeve extends over the two clutches to protect all moving parts from dust or dirt.

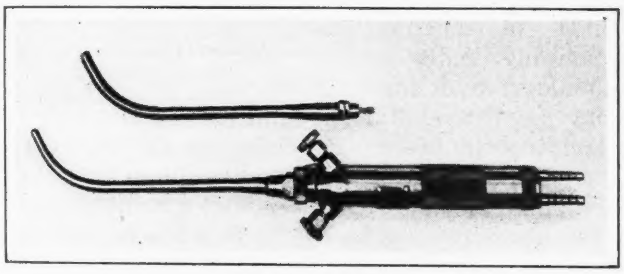
The attachment is adjustable to take care of a variety of sizes of nuts and bolts, and when adjusted, every nut or bolt will be driven to the same predetermined tightness. Several sizes of the attachment are made for driving any nut or bolt from 3/16 to 1 1/2 inches in size.

OXWELD AIRCRAFT BLOW-PIPE

A blow-pipe designed especially for welding aircraft fuselages, but which may be employed for welding operations on all kinds of light tubing or sheet steel, has recently been placed on the market by the Oxweld Acetylene Co., 30 E. 42nd St., New York City. Like other blow-pipes made by the same concern, this type W-15 is of the injector type and can be used on a low-pressure acetylene supply.

Seven welding heads are supplied with the blow-pipe, although only two are illustrated. The heads are equipped with drawn copper tips to withstand high temperatures, and are curved to reach into otherwise inaccessible places. Each welding head is detachable as a unit, and each injector can also be detached from the welding head and replaced if necessary.

Valves for adjusting the oxygen and acetylene pressure are located on the handle in such a position that they can be operated by the thumb and finger of the hand holding the blow-pipe, leaving



Oxweld Blow-pipe Especially Designed for Welding Airplane Fuselages

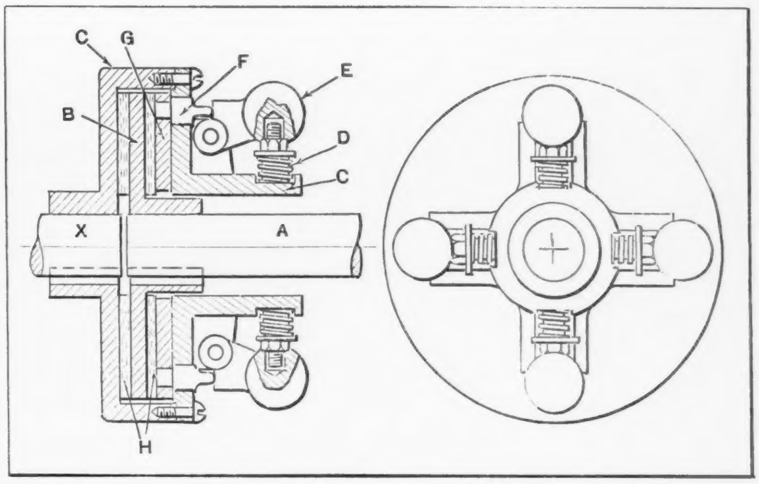
the other hand free. This blow-pipe weighs slightly over 9 ounces with the largest tip attached.

WASHBURN ACCELERATING CLUTCH

An automatic mechanical unit designed for use as a clutch between a motor and machine to reduce the starting torque and permit the machine to start with a uniform acceleration, has recently been developed by the Washburn Shops of the Worcester Polytechnic Institute, Worcester, Mass. This accelerating clutch relieves both the machine and the motor of undue shock and strain, saves repairs, and requires a less expensive electrical control.

The operating principles of the clutch can best be understood by reference to the illustration, which shows a direct motor drive to a shaft that is to be driven at the same speed as the motor. *A* indicates the motor shaft and *X*, the shaft of the machine. When current is applied to the motor, the only load on the motor is derived from the slight pressure of friction disks *H* on the sides of disk *B*, the latter being keyed to the motor shaft. This pressure is so slight that the motor readily attains its speed in two or three seconds, the pressure of the disks *H* being controlled by four springs *D* which operate through bellcranks *E* to actuate pins *F*. The latter are fastened to pusher-plate *G*.

With the motor operating at full speed and with the slight spring pressure, slippage takes place between the friction disks *H* and disk *B*, but there is a tendency to set head *C* in motion. When head *C*, which is keyed to shaft *X*, reaches a speed sufficient for centrifugal action to take place in bellcranks *E*, pressure is increased on the pusher-plate and between disks *H* and *B*. This results in increasing the speed of head *C* and, in turn, increases the centrifugal action with a resulting increase in the speed of the head. The cycle continues until the speed of head *C* is equal to that of disk *B*.



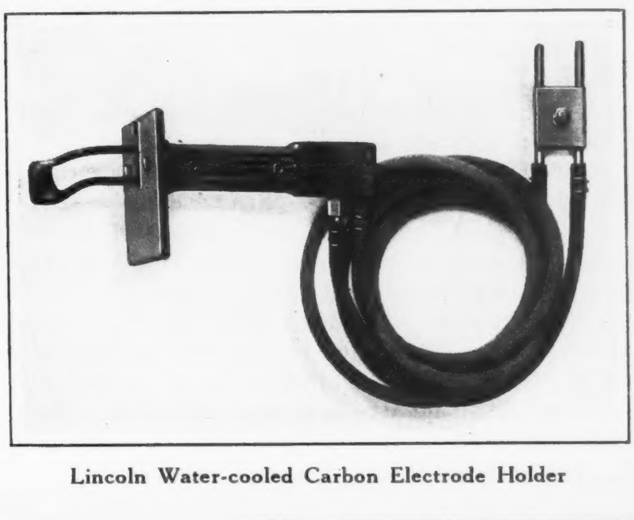
Washburn Clutch which Reduces the Starting Torque of Motor Drives

In addition to this design, which is used as a direct coupling between motors and machines, the clutch may be belt or chain driven. The clutch operates either horizontally or vertically.

LINCOLN WATER-COOLED CARBON ELECTRODE HOLDER

A water-cooled carbon electrode holder intended for use in heavy-duty manual welding by the carbon-arc process, has recently been developed by the Lincoln Electric Co., Cleveland, Ohio. While designed primarily to insure greater comfort and less fatigue for the welder operator, another advantage claimed for the holder is that it effects economy in the use of carbon electrodes, it being possible to weld with the arc tip of the electrode projecting less than 3 inches from the holder. The holder weighs only 3 1/4 pounds in the operator's hand.

One of the features which contributes to the light weight is the use of a hose which carries the water



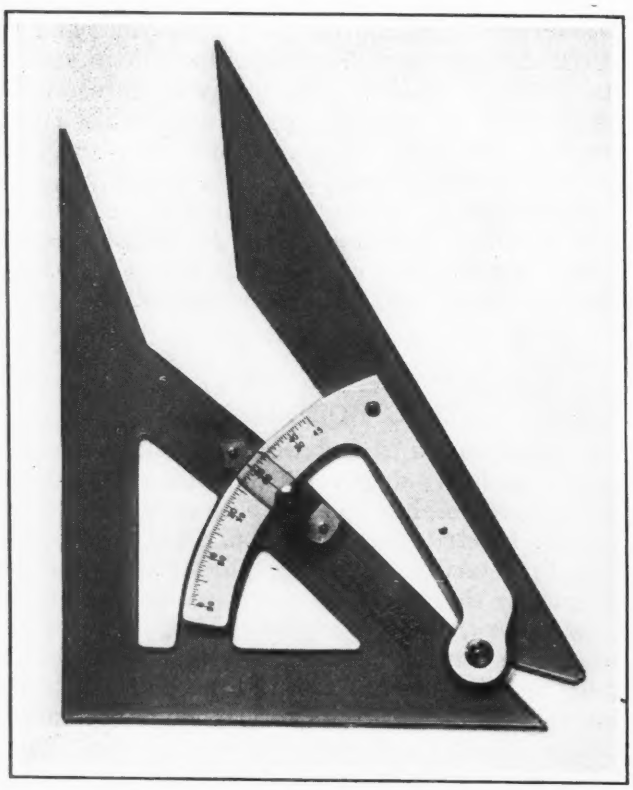
Lincoln Water-cooled Carbon Electrode Holder

and the cable to the holder. Each of the two water tubes contains a light cable extending from the connector to the holder. The water flowing through the holder also acts as a cooling agent for the cables.

This holder is manufactured in several sizes for use with 1/4-, 5/16-, 3/8- and 1/2-inch carbons. A hand shield of compressed magnesium protects the hand of the operator from the arc rays. Both the electrode holder and the flexible water-cooled lead-off cable are being placed on the market by the company mentioned.

ADJUSTABLE PROTRACTOR TRIANGLE

A universal adjustable protractor triangle, now being placed on the market by E. S. Brown, Garrow St., Auburn, N. Y., under the trade name of "New Facila" embodies several improvements over the "Facila" protractor described on page 556 of March, 1927, MACHINERY. The new protractor triangle, for instance, is furnished with an ivory-grain celluloid protractor of new design, and an annular interlocking hinge connects the movable arm with the main portion of the triangle. This interlocking hinge has a large bearing surface and insures smooth action and long life of the device.

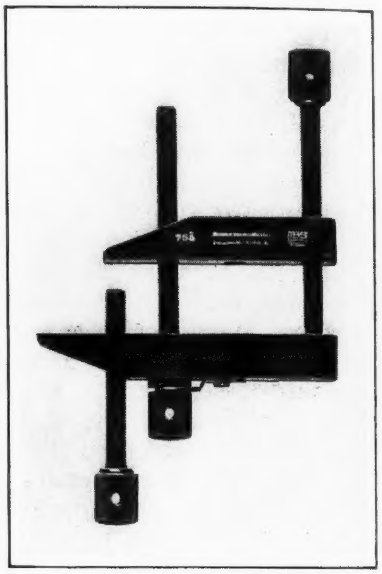


"New Facila" Universal Adjustable Protractor Triangle

The triangle facilitates the work of the draftsman by enabling lines to be drawn conveniently to any angle. Different angular positions of the movable arm are obtained by shifting the position of the arm until the desired angle graduation on the celluloid protractor coincides with the hair-line on the celluloid piece which bridges the protractor in front of the knurled clamping knob. In the illustration, the adjustable arm is set for drawing lines at angles of 30 and 60 degrees. This device is made in three sizes with 7-, 10- and 12-inch arms.

BROWN & SHARPE TOOLMAKERS' CLAMP

One of the jaws on the No. 756 toolmakers' clamp recently designed by the Brown & Sharpe Mfg. Co., Providence, R. I., is considerably longer than those ordinarily provided on this type of clamp, and an auxiliary clamping screw is provided. The extended jaw permits the holding of pieces that could not be gripped with the ordinary jaws, while the auxiliary screw gives support and rigidity to prevent the pieces from slipping. A spring attachment on the adjusting screw holds the loose jaw in position at all times.

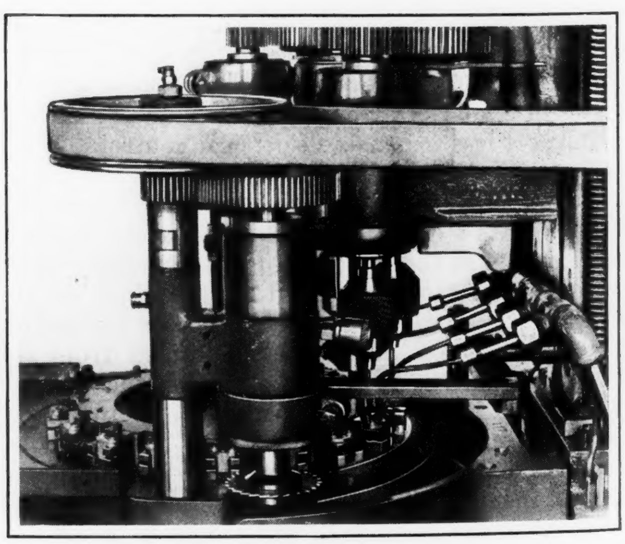


Toolmakers' Clamp with One Long Jaw

This clamp can be used with any Brown & Sharpe vee or "Handy" block. The jaws are rounded on the ends to allow clamping under a shoulder, and the long jaw extends far enough over the top to permit clamping the piece. By changing the position of the screws in the jaws, this clamp can be used as a regular clamp, with the added advantage of an auxiliary screw. The clamp is made in two sizes with a maximum jaw opening of 2 and 2 1/2 inches, respectively.

ANDERSON SLOTTING OR MILLING SPINDLE

Dial-feed tapping machines built by the Anderson Die Machine Co., Bridgeport, Conn., may now be equipped with a milling or slotting spindle which has recently been designed by the concern. In the illustration, this spindle is shown pivoted outside the feeding dial proper. It is operated by means of a cam placed on the vertical shaft of the ma-



Slotting or Milling Spindle Applied to an Anderson Dial-feed Tapping Machine

chine, which synchronizes its movements with those of the machine elements. The particular operation illustrated consists, first, of slotting the small castings, and then tapping three holes at right angles to the slot; the fixture is then indexed and the hole into which the slot is cut, is tapped with a No. 10 tap having 32 threads per inch.

STERLING SEGMENTAL WHEEL CHUCKS

Segmental wheel chucks designed for use on various makes of grinding machines have recently been brought out by the Sterling Grinding Wheel Co., Abrasive Division of the Cleveland Stone Co., Tiffin, Ohio. One of the features of these chucks to which particular attention is called is that changing of the abrasive segments is easy, because the segments are mounted directly on the chucks.

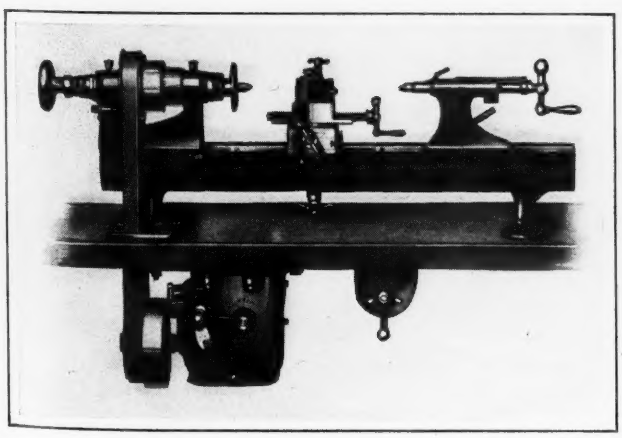
Sterling Chuck for Segmental Grinding Wheels

The chucks are made for Pratt & Whitney grinding machines in 14- and 22-inch wheel sizes; for Blanchard grinding machines, in 16- and 18-inch wheel sizes; for Diamond grinding machines, in 22-, 24- and 30-inch sizes; and for Osterholm grinding machines in the 20- by 8- by 10-inch size.

STARK MOTOR DRIVE FOR BENCH MACHINES

An individual motor drive which can be adapted to bench lathes and bench milling machines is a recent development of the Stark Tool Co., Waltham, Mass. It is intended that this unit be mounted beneath the bench on which the lathe or miller is located, in order to drive the machine through a single belt, thus eliminating all overhead shafting and belting and leaving the bench space clear. In the illustration, the unit is applied to a bench lathe.

Three speed changes are obtainable by shifting a single lever, which can be done while the machine is running, and three more speeds are available by shifting the belt to the second step of the cone driving pulley. When a reversing motor can be used, the same ranges of speeds may be obtained in reverse. The driving gears in the speed reduction are non-metallic and mesh with hardened steel gears running on a hardened and ground shaft. The three shafts are mounted in Timken tapered roller bearings. The speed reduction is designed on the sliding-key principle.

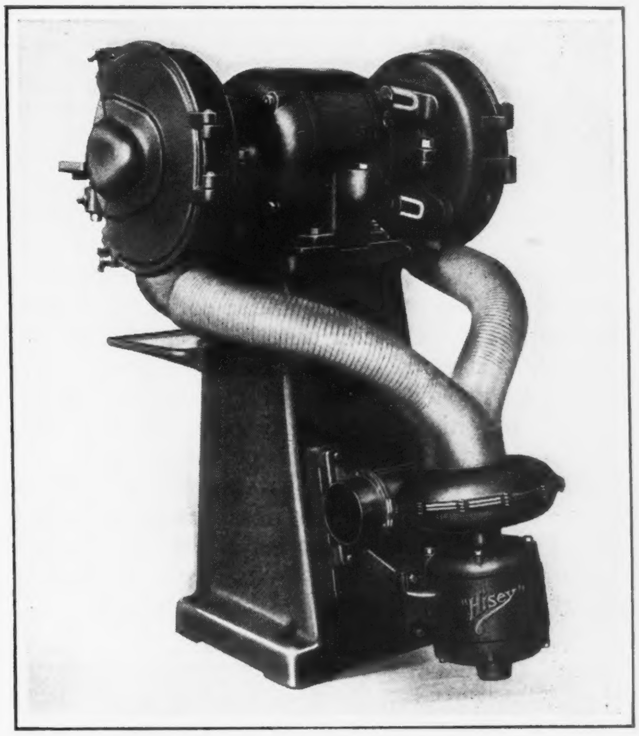


Stark Bench Lathe Equipped with Motor Drive Unit

The clutch is of a simple expanding type having only four moving parts. It is easily accessible for adjustment, and is controlled by means of the conventional foot-treadle so as to leave both hands of the operator free. The net weight of this motor drive unit, with regular equipment, is 75 pounds.

HISEY EXHAUSTER EQUIPMENT

Grinders of 10-, 12-, and 14-inch wheel capacity built by the Hisey-Wolf Machine Co., Cincinnati, Ohio, as well as buffing and polishing machines of 8-, 10-, 12-, and 14-inch wheel capacity, may now be provided with exhauster equipment, as shown in the illustration. This equipment has a ball-bearing motor drive. Its motor is controlled from the same automatic starter that governs the operation of the main driving motor of the machine.



Hisey Grinder with Motor-driven Exhauster

AIR-COOLED BALL-BEARING GRINDERS AND BUFFERS

Grinders and buffers equipped with enclosed ball-bearing air-cooled motors are being introduced on the market by Sterling Electric Motors, Inc., Los Angeles, Cal. These machines are built in four sizes, ranging from 1/2 to 2 1/2 horsepower, inclusive, for operation on single-phase 110- or 220-volt alternating current, and in five sizes, from 1/2 to 5 horsepower, inclusive, for operation on 220-

or 440-volt, two- or three-phase alternating current.

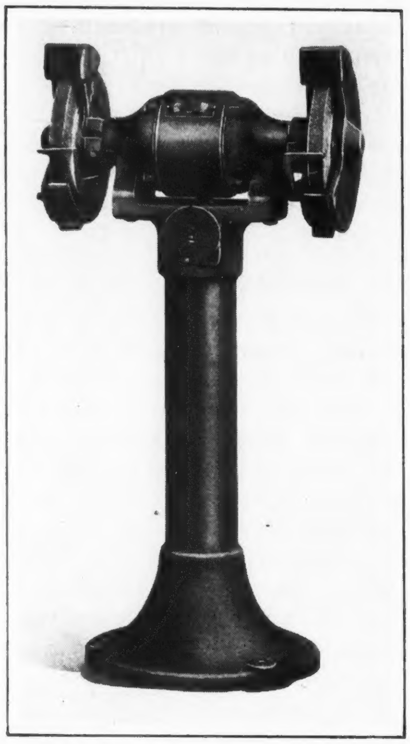
The illustration shows a floor-pedestal type of grinder. Buffing and polishing machines of the pedestal type are similar in design, with the exception that the shaft is extended considerably further on each side. In a combined buffer and grinder, there is a long shaft extension on one side and a short extension on the other. Bench-model grinders, buffers, and polishers are also made by the concern.

* * *

INDICATOR FOR DETECTING COMBUSTIBLE GASES

A portable instrument that immediately detects the presence of a wide range of combustible gases or vapors, and indicates whether or not the atmosphere containing these gases is safe to breathe and safe for flames or fire, has been developed by the Union Carbide & Carbon Research Laboratories, Inc., 30 E. 42nd St., New York City. The indicator comprises a detector head or combustion chamber, a meter case, and a portable storage battery. The battery is carried on a leather belt worn around the waist of the user, and to this belt are hooked the detector head and a coiled cable which connects it to the meter case. The latter is carried by a light strap passed around the user's neck, or it may be hooked to the battery belt.

In using this outfit, the detector head is placed in the atmosphere to be tested, being held in the hand, raised vertically, or extended horizontally on a pole, or lowered by means of the cable into a manhole, tank, etc. The outfit may be safely employed in all gas-air mixtures with the exception of those containing acetylene or hydrogen.



Pedestal-type Grinder Built by Sterling Electric Motors, Inc.

MAGNET FOR REMOVING METAL FROM THE EYE

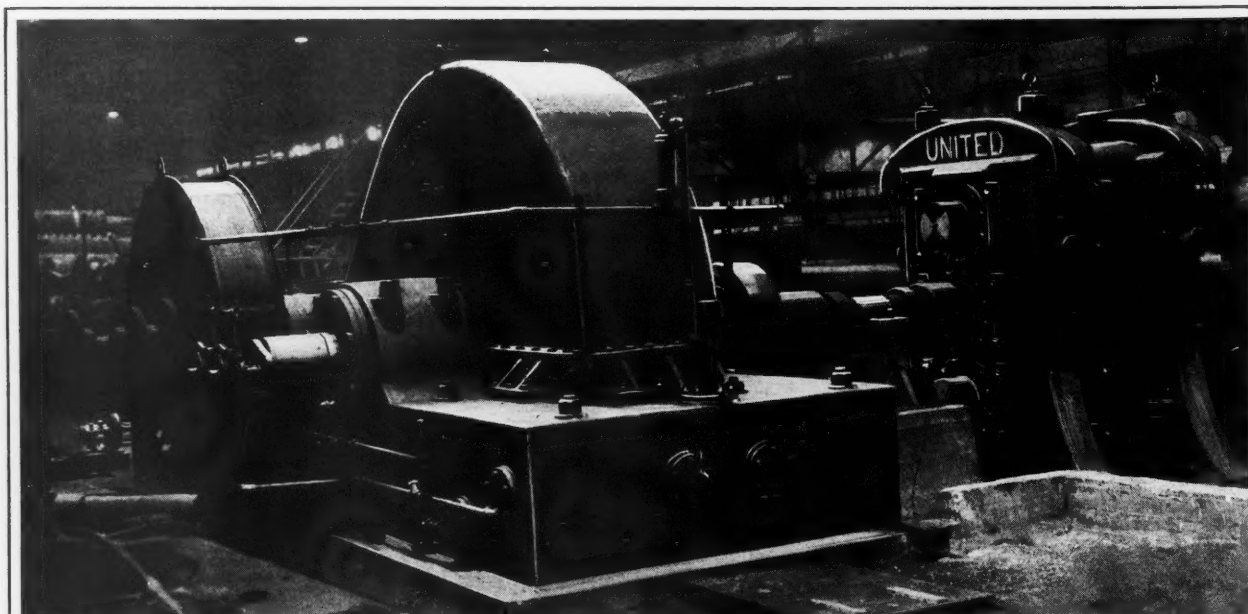
Iron and steel particles can be conveniently removed from the eyes and flesh of workmen by means of the "Magneprobe," which is a permanent magnet in the form of a surgical probe, and is about the size of an ordinary lead pencil. One end of the instrument has a point to facilitate the removal of particles from eyes, while the other end is flattened for use in cases where a fragment has penetrated into the flesh. This magnetic probe is made of a high cobalt steel. It is manufactured by V. Mueller & Co., Ogden Ave., Van Buren and Honore Sts., Chicago, Ill.

* * *

LARGE HERRINGBONE-GEAR SPEED REDUCER

Power for driving two stands of 28-inch bar mills in the plant of the Timken Roller Bearing Co., Canton, Ohio, is transmitted from the motor to the bar mills through the herringbone-gear speed reduction unit here illustrated. This unit was built by Gears & Forgings, Inc., Cleveland, Ohio, and is equipped with Timken tapered roller bearings on both pinion and gear shafts.

The motor in this drive has a rating of 1500 horsepower (4000 horsepower at peak loads), operates on alternating current, and runs at 360 revolutions per minute. Two 8-foot flywheels, each weighing 16,000 pounds, are mounted on the pinion shaft to take care of the peak loads resulting in the operation of the mills. A 1000-horsepower herringbone-gear reduction unit is also being built for a new Timken seamless-tube piercing mill and a herringbone-gear tandem drive is being built for a new tin mill of another company.



Speed Reducer Built by Gears & Forgings, Inc., which Transmits Drive of 1500-horsepower Motor

Tools and Methods for Machining Aluminum*

Detailed Directions for Making Tools for Turning, Facing, Planing and Milling Aluminum—Cutting Lubricants or Coolants for Machining Aluminum

By R. L. TEMPLIN, Chief Engineer of Tests, The Aluminum Co. of America

IN view of the fact that machinists are more familiar with tools and methods for cutting brass and mild steel than they are with tools and methods for cutting aluminum, it is proposed first to make a brief comparison of the two, proceeding thereafter to a more specific discussion of the type of tools used for machining aluminum.

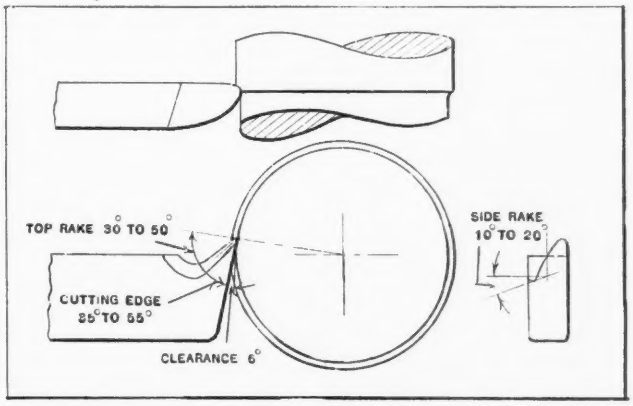


Fig. 1. One Type of Lathe Tool that May be Used for Machining Aluminum

Cutting tools commonly used for machining free-cutting brass usually have little, if any, top and side rake; they are ground on a medium to coarse abrasive wheel and used without any cutting compound or with a cutting compound composed of paraffin oil. Those ordinarily used for steel have some top and side rake, are usually ground on a medium to fine abrasive wheel, and are often used with soluble-oil cutting compounds.

The proper tools for aluminum and its alloys should have appreciably more side and top rake than the tools for cutting steel; they should have very keen edges obtained by grinding with very fine abrasive wheels, supplemented in many cases by hand-stoning with an oilstone; and they should be used with suitable cutting compounds whenever possible. In many cases, the tools suitable for machining aluminum and its alloys are not appreciably different from those commonly used for cutting hard woods.

The front clearance of a tool most suitable for machining aluminum and its alloys should be about 6 degrees, the top rake from 30 to 50 degrees, making the total angle of the cutting edge from 35 to 55 degrees. A side rake of from 10 to 20 degrees will materially assist in the cutting action. The values given usually produce the best results, but in some cases, departures may be made from them, depending on the particular alloy being machined, the type of tool, and any unusual conditions under which it may be used..

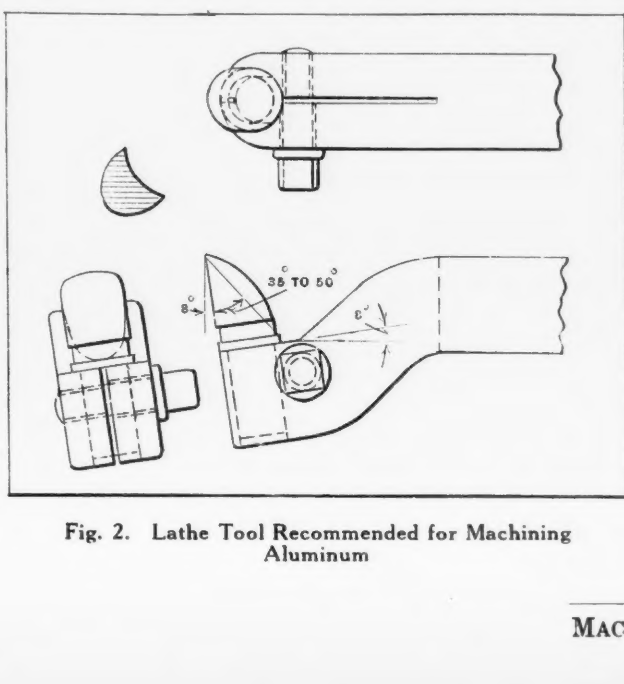


Fig. 2. Lathe Tool Recommended for Machining Aluminum

Keen Cutting Edges are of Importance

In all cases it is essential that the cutting edges of the tools be keen, smooth, and free from grinding wheel scratches, burrs, or wire edges. This requirement can hardly be overemphasized, as upon it depends, to a large extent, the success of machining aluminum and its alloys. Keen tool edges are best obtained by finish-grinding on a fine or very fine abrasive wheel, followed by hand-stoning with a fine or very fine oilstone, taking care to see that neither the angles nor the contours of the cutting edge are appreciably modified during the stoning operation.

When a blunt-edged tool, suitable for brass, is used for machining aluminum, the chip is not sheared from the piece being machined, but is pulled off the work just ahead of the cutting edge of the tool, leaving a rough surface. With the continued use of such a tool, small particles of aluminum adhere to the cutting edge, build up, and form a projection of hard-worked aluminum, which tends to function as the cutting edge of the tool. However, this projection of hardened aluminum, while appreciably harder than the material being machined, is not of sufficient hardness to cut the aluminum stock properly and causes excessive heating of both the tool and the work.

Decreasing the cutting-edge angle of the tool lessens the extent to which the aluminum is deposited on the tool, until a point is reached where little, if any, metal will stick to the cutting edge; that is, when the angle of the cutting edge is small enough, the tool will cut the chips from the work and not tear or pry them off. In order to obtain a smooth surface on the work, the cutting tool should curl the chips as little as possible.

*Based on a paper presented by the author before the American Institute of Mining and Metallurgical Engineers.

Types of Tools Suitable for Turning in the Lathe

Outside turning tools for use in the lathe when machining aluminum and its alloys may be of the form suggested in Fig. 1, but tools of this kind, when prepared from the usual tool-bit stock, require considerable grinding in order to produce the desired shape, and it is sometimes difficult to maintain the different angles when regrinding.

A much better tool is shown in Fig. 2. The bit of this tool is made from high-carbon or high-speed steel rod stock, properly hardened and tempered. Resharpening is readily accomplished by holding the bit by its shank in the chuck or collet of a tool-grinding machine or an engine lathe, and then simply grinding off the outside diameter until a keen edge is obtained. After each grinding, the tool should be stoned, as indicated previously. Using such a tool and resharpening procedure, it is comparatively easy to maintain the desired shape throughout the useful life of the tool.

This tool has proved more economical than those ground from square or rectangular tool-bit stock, and possesses certain adjustable features. When the clamp screw of the tool-bit holder is loosened, the bit may be rotated to various positions to suit different working conditions. Tools of this form may be used for both rough-turning and finishing cuts, but where the same tool is used for both, it should be re-stoned before being used as a finishing tool. With some modifications, either of these two forms of tools may be adapted for boring operations.

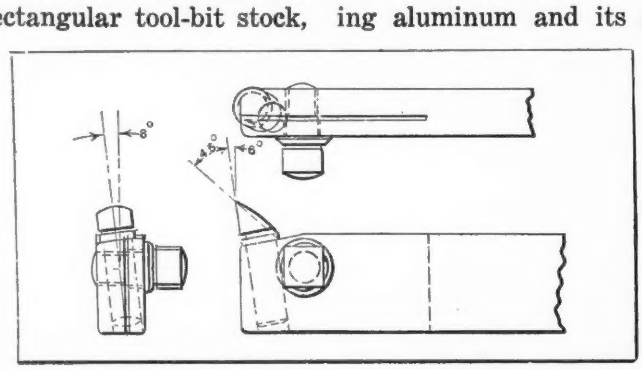


Fig. 3. Planer and Shaper Tool for Machining Aluminum

These tools, like most others suitable for machining aluminum and its alloys, tend to produce continuous chips, which usually are curled only a little when the tools are functioning properly. Decreasing the top- and side-rake angles has a tendency to curl the chips more, and consequently, to break them up.

Pure aluminum and many of its alloys are capable of being machined to a mirrorlike surface, but this surface is easily scratched by the chips when they come into forcible contact with it. The chips receive an appreciable amount of working and are much harder than the stock from which they are cut.

Parting or Cutting-off Tools, Facing Tools, and Circular Forming Tools for Aluminum

Parting tools for machining aluminum and its alloys should have from 12 to 20 degrees top rake and be stoned so that their cutting edges are keen and smooth. With such tools, the front clearance angle should be decreased to about 3 or 4 degrees.

Facing tools should be ground so as to have a side rake similar in amount to that indicated for the top rake of the outside turning tools.

Circular forming tools as used in automatic screw machines are sometimes difficult to design so that they will machine aluminum and its alloys properly. In such cases, the best results are often obtained by using a roughing tool first and following by a very light finishing cut with the forming tool.

Planer and Shaper Tools for Aluminum

The tool shown in Fig. 2 can be readily adapted to planer and shaper work by using a holder like that shown in Fig. 3. Here, again, the tool may be used for both roughing and finishing work when machining aluminum, but a side cutting tool, as shown in Fig. 4, can be used to better advantage for still heavier roughing cuts.

When finishing aluminum in a planer or shaper, care must be taken to prevent the tool from striking or rubbing on the finished surface during the return stroke of the tool. If the tool strikes, the work may be scratched and the thin edge of the tool broken.

Cutters for Milling Aluminum

Milling cutters, straddle mills, end-mills, and similar cutters work to best advantage in machining aluminum and its alloys if they are of the coarse-tooth spiral type and have a considerable amount of top rake on their cutting edges. Such tools have been found to work very well when machining steel. In some instances, milling cutters with nicked teeth assist in breaking up the chip. Face milling cutters with inserted teeth are satisfactory for machining aluminum. Such cutters should be designed so that the inserted teeth have appreciable top and side rake. The comparatively new helical milling cutters, primarily designed for machining steel, work especially well with aluminum and its alloys if the cutting edges are provided with suitable top rake. The same may be said of staggered-tooth milling cutters.

Threading Tools Should Have Large Rake Angles

Excellent threads may be chased in even the softest aluminum in an engine lathe, using a single-pointed threading tool with considerable top and side rake. The tool must be ground so as to give the required thread contour. Hand and machine taps will produce smooth and accurate threads in aluminum if they are of the spiral-fluted ground-thread type. Experience has shown that such taps should have a right-hand spiral flute when intended to cut a right-hand thread, and the spiral angle should be similar to that used in an ordinary twist drill.

Satisfactory taps for use in aluminum have been made by chasing threads on annealed high-carbon twist drills followed by rehardening and grinding. Taps that have a short spiral ground on their front end, such as the "Gun" tap, will often work satisfactorily in aluminum when there is room for the chips to be forced ahead of the tap and when the thread to be cut is not tapered, but taps of this type are not satisfactory for taper threads or for use as

bottoming taps. In using spiral-fluted taps, especially in automatic screw machines, it has been found advantageous to grind a top rake on the back of the lands, so that there will be less tendency for the tap to seize when backing out of the work.

Slightly over-size taps often assist materially in maintaining the required dimensions of holes in aluminum and its alloys. That is, aluminum, on account of its lower modulus of elasticity, has more recoverance after a tapping operation than steel, and this is best compensated for by the use of slightly over-size taps. Thread chasers for self-opening die-heads and collapsible taps should be ground with appreciable top and side rake.

Twist Drills Must Have a Large Spiral Angle

Ordinary twist drills sometimes give trouble in machining aluminum and its alloys. Like all other cutting tools for aluminum, twist drills should have keen edges, and a copious amount of cutting compound should be used with them. In some instances, the single-fluted twist drills used in drilling hardwood have been found superior to the usual form of drill. A still better drill for aluminum is one in which the flutes have a greater spiral angle; that is more twist per inch. Straight-fluted twist drills such as are often used in drilling brass are unsuited for drilling aluminum and its alloys.

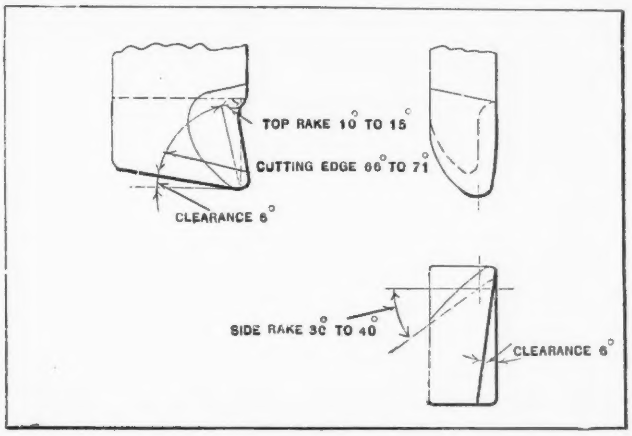


Fig. 4. Planer Tool Intended for Roughing Aluminum

Reamers, Saws, and Files for Aluminum

Reamers of the spiral-fluted type, generally used for machining steel, produce the best results in machining aluminum and its alloys.

Saws most suitable for cutting aluminum should preferably be of the coarse-tooth type. In many cases, saws that are used for cutting hardwood will be found quite satisfactory for sawing aluminum if they are used with a lubricant. Hand hacksaw blades of the "wavy-set" type work especially well with aluminum.

Ordinary files, especially those with fine teeth, do not work well on aluminum, because the cuttings stick in the teeth, but there are a number of coarse-tooth files, such as the "Vixen," "Shearkleen" and "Premier," which work very well on aluminum and its alloys. The success of these files depends to a large extent upon the top and side rake of their cutting teeth. Quite recently chromium-plated files have appeared on the market, and give much promise of being eminently satisfactory for use on aluminum, irrespective of the size and form of teeth.

Use High Speeds and Fine Feeds for Machining Aluminum

Generally, aluminum can be machined to best advantage by using comparatively high speeds and fine to medium feeds. Surface speeds varying from 500 to 800 feet per minute are possible under some conditions with ordinary carbon-steel tools, and appreciably higher speeds can be used with high-speed steel tools. The feed may vary from as much as 1/4 inch, for roughing cuts, to a few thousandths of an inch for finishing cuts. Usually, the finer the feed, the higher the speed; and the more curl there is to the chip, the slower the speed. Slower speeds and heavier feeds give better results when a heavier cutting compound is used. An increase in the amount of metal removed from the stock in a given time may often be obtained to better advantage by increasing the speed rather than the feed when using the tools described; but tools having keen, thin edges will not work satisfactorily when chattering occurs, as this action will break off the edge of the tools.

Aluminum, like other metals, tends to show a rise in temperature when machined with coarse feeds, and since the linear coefficient of expansion of aluminum is appreciably higher than that of steel, for example, the finished work may fail to meet the required dimensions unless due allowance is made for the expansion of the metal. In engine lathe operations, a common trouble, with heavy coarse-feed cuts, is the excessive friction set up on the lathe centers due to the expansion of the metal with a rise in temperature. When appreciable heating occurs, the work should be cooled before calipering and finishing to size, in order that the required dimensions may be obtained.

Cutting Lubricants or Coolants for Machining Aluminum

Some of the alloys of aluminum have been machined successfully without any lubricant or cutting compound, using tools of the form described, but in order to obtain the best results, some form of lubricant is desirable. For many purposes, a soluble cutting oil is good. Ordinary carbon oil or kerosene will often serve, but usually it works better when mixed with pure lard oil. For heavy cuts and slow feeds, such as in roughing work or tapping, pure lard oil has been found to give very satisfactory results.

Cutting compounds composed of paraffin oil, such as are used in machining brass, are quite unsatisfactory for machining aluminum. For milling, sawing, and drilling, the soluble cutting oils are satisfactory and more economical than the kerosene or kerosene and lard oil lubricants.

When the work has been rough-machined without using a lubricant, sometimes small particles of the metal adhere to the cutting edge of the tool. These should be removed by stoning the tool before using it for finishing work. A continuous and copious supply of lubricant should be fed to the tool, in order to produce the best results.

PERSONALS

Dr. Haig Solakian, for several years a member of the metallurgical staff of the National Bureau of Standards, has become chief metallurgist for the Geometric Tool Co., New Haven, Conn.

John C. Spence, formerly works manager of the Machine Division of the Norton Co., Worcester, Mass., has bought an interest in the Universal Boring Machine Co. of Hudson, Mass., and becomes works manager of the company.

Frank Moore Studio, Cleveland

Charles J. Stilwell

Charles J. Stilwell was elected a vice-president and director of the Warner & Swasey Co., Cleveland, Ohio, at the last annual meeting of the company. Mr. Stilwell has been with the Warner & Swasey Co. since his graduation from Denison University in 1910. He has successively held the positions of salesman, branch manager, and European representative, and has been sales manager since 1923.

William J. Burger was elected a director of the Warner & Swasey Co., Cleveland, Ohio, at the recent annual meeting of the company. Mr. Burger served his apprenticeship with the Warner & Swasey Co., and has been works manager since 1924.

H. A. Baker has been appointed service manager of the International General Electric Co., with headquarters in New York City. Mr. Baker succeeds C. F. Neave, who has been made manager of the newly organized refrigeration department of the company.

R. F. Crego, formerly sales manager of the L. C. Smith Bearing Co., Chicago, Ill., has recently joined the sales organization of Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill. Mr. Crego will take care of customers in the loop territory of Chicago.

O. B. Wilson has been placed in charge of the Cleveland office of the Brown Instrument Co., 819 Hippodrome Building. Mr. Wilson has been with the Brown Instrument organization over five years, and has had wide experience in serving the needs of instrument users.

William J. Corbett has resigned as secretary-manager of the Steel Founders' Society of America to become assistant to the president of the Fort Pitt Steel Casting Co., McKeesport, Pa. Mr. Corbett is a prominent steel foundryman, having been engaged in the industry since 1914, when he graduated from the Carnegie Institute of Technology.

W. H. Brand, vice-president of the First Wisconsin Co., was elected a director of the Interstate Drop Forge Co., 27th St. and Capitol Drive, Milwaukee, Wis., at the annual meeting of directors. The Interstate Drop Forge Co., is part of an affiliated group consisting of the Chain Belt Co., the Federal Malleable Co., and the Sivyer Steel Casting Co., all of Milwaukee.

Mrs. Nellie Scott Rogers, for the last twenty-five years treasurer of the Bantam Ball Bearing Co., Bantam, Conn., has disposed of her interests in the company and retired for a much needed rest. Mrs. Rogers is one of the six women associate members of the American Society of Mechanical Engineers, and is also a member of the Society of Automotive Engineers. She is well known as an expert accountant and financial manager.

Harry S. Kartsher has recently joined the Commercial Tool Co., Plymouth Building, 2026 E. 22nd St., Cleveland, Ohio. Mr. Kartsher has been machinery designer with the Niles-Bement-Pond Co., gage engineer with the Ordnance Department under Colonel E. C. Peck during the World War, mechanical engineer with the Cleveland Twist Drill Co., standards engineer with the White Motor Co., and industrial and designing engineer with the Trundle Engineering Co.

James A. Muir has been appointed assistant to the president of the Taylor-Winfield Corporation, Warren, Ohio, manufacturer of Taylor-Winfield electric welders. Mr. Muir, who has been connected with the welding machine industry for more than twenty-five years, was one of the originators of the old Toledo Electric Welder Co., which was absorbed by the Thomson Electric Welding Co., and was until recently sales engineer for the latter concern. Manufacturing facilities have been appreciably enlarged, and the personnel of the engineering department has been increased.

W. S. Rogers, president of the Bantam Ball Bearing Co., Bantam, Conn., and a pioneer in the ball bearing industry, has sold out his control in the company and retired. Thirty years ago he made ball bearings for all the early types of automobiles, which were then in the inventive stage. For forty-one years he was an active member of the American Society of Mechanical Engineers, and has had nearly fifty years experience in engineering and management. Over thirty years ago, he contributed to Machinery a series of stories known as "The Doings of the Shellfish Club."

Byron T. Mottinger, formerly special engineer with the Federal Machine & Welder Co., Dana Ave., Warren, Ohio, has become president and general manager of the General Welder Co., 95 Steiner Ave., Akron, Ohio. This company was recently formed to engage in the manufacture of special welding machines for mass production. Paul C. Zarrs, formerly research engineer with the Taylor Winfield Co., Warren, Ohio, has been made director of engineering of the General Welder Co. Prior to coming to this company, Mr. Zarrs was director of engineering for the Deutsche Schweismaschinen Fabrik of Dusseldorf, Germany.

Andrew Wells Robertson, of Pittsburgh, Pa., was unanimously elected chairman of the board of directors of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., at a recent meeting of the board. Mr. Robertson will withdraw from his other business activities and devote his entire time to the Westinghouse Co. Since the death of Guy E. Tripp in 1927, the chairmanship of the board has been held temporarily by Paul D. Cravath, general counsel of the company. Mr. Cravath will continue in the capacity of general counsel.

Frank Moore Studio, Cleveland

C. M. Taylor

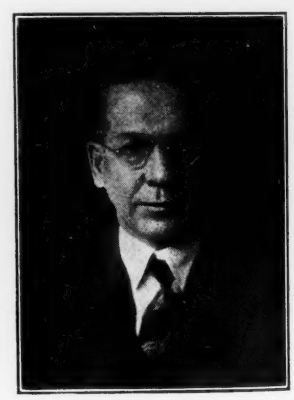


Photo by Wm. Henry, New York

Andrew Wells Robertson

C. M. Taylor has been appointed sales manager of the Lincoln Electric Co., Cleveland, Ohio, manufacturer of "Stable-Arc" welders and "Linc-Weld" motors. Mr. Taylor entered the employ of the Lincoln Electric Co., in 1916, immediately upon graduating from the Western Reserve University, and soon was made foreman of the assembly and test departments. He left the employ of the company in 1917 to enlist in the Army, and upon his return at the end of two years was made time study demonstrator and observer. In 1923 he was promoted to the position of factory manager, and in 1925 was elected vice-president of the company.

C. W. Yerger, formerly eastern district manager of the Cutler-Hammer Mfg. Co., has assumed the duties of sales manager of the Hanson-Van Winkle-Munning Co., Matawan, N. J. This step has become necessary in order to enable E. N. Boice, secretary, who in addition to his other activities has been directing the sales of the company, to give full time to his regular executive duties. Mr. Yerger had been associated with the Cutler-Hammer Mfg. Co. since 1908. Before becoming eastern district manager, he was, successively, engineer, Pacific Coast representative, and manager of the Cincinnati, Washington, and Boston offices, in addition to spending approximately eighteen months in England in the interests of the company.

TRADE NOTES

MACHINE PRODUCTS Co., has changed its name to the OHIO GEAR Co., 1333 E. 179th St., Cleveland, Ohio. There has been no change in the personnel, policy, or location of the company.

BROWN INSTRUMENT Co., 4485 Wayne Ave., Philadelphia, Pa., announces that the Buffalo office of the company has been moved from 624 Ellicott Square to 402 Marine Trust Building.

CARPENTER STEEL Co., Reading, Pa., has appointed Horace T. Potts & Co., Philadelphia, Pa., warehouse distributors for carbon and alloy tool steels in the Philadelphia and eastern Pennsylvania district.

WATSON-STILLMAN Co., 73 West St., New York City, manufacturer of hydraulic machinery, has appointed the Midvale Mining & Mfg. Co., 705 Olive St., St. Louis, Mo., representative of the company in the St. Louis district.

FREW MACHINE Co., 124 W. Venango St., Philadelphia, Pa., has just taken over the line of milling machines formerly built by John Steptoe & Co. of Cincinnati, Ohio, and is in a position to furnish repair parts to concerns who are using these machines.

FOOTE BROS. GEAR & MACHINE Co., 232-242 No. Curtis St., Chicago, Ill., states that the eastern branch office of the company is located in the Transportation Building, 225 Broadway, New York City, and not in the Woolworth Building as announced in February MACHINERY.

C. F. PEASE Co., 822 N. Franklin St., Chicago, Ill., has established a new Pacific Coast sales office at 501 S. Spring St., Los Angeles, Calif., under the direction of Ralph S. Gibson, western sales manager, who will devote his entire attention to the western coast states territory.

PREST-O-LITE Co., INC., 30 E. 42nd St., New York City, has established a new Prest-O-Lite acetylene plant at 1241 N. McLean Blvd., Memphis, Tenn. J. Brown is superintendent of the Memphis plant, and C. A. Anderson is district superintendent, with headquarters at Birmingham, Ala.

LINDE AIR PRODUCTS Co., 30 E. 42nd St., New York City, has started operations in a new oxygen producing plant at 1241 N. McLean Blvd., Memphis, Tenn. The old plant at 48 W. McLemore Ave. will be discontinued. E. C. Heyman, superintendent of the old plant, will assume similar duties at the new plant.

KINITE CORPORATION, Milwaukee, Wis., has appointed the Bissett Steel Co., with offices at Cleveland, Cincinnati, and Pittsburgh, and H. Boker & Co., Inc., New York and Boston, distributors for Kinite steel alloy. This alloy is supplied in the form of castings or bar stock in standard sizes of flats, squares, and rounds, and as welding rods.

VEEDER-ROOT, INC., Hartford, Conn., has consolidated its purchasing under J. M. Brown, purchasing agent at the Hartford plant. Mr. Brown will take care of the combined purchasing at the Hartford office. B. W. Aspelin, formerly purchasing agent at the Bristol plant, has become purchasing agent for the Hartford Machine Screw Co.

MORSE COUNTERBORE & TOOL Co., formerly located at 4135 Vermont Ave., Detroit, Mich., has purchased the plant of the Chadwick Mfg. Co., 12281 Turner Ave., Detroit, to which the business has been moved. This acquisition gives additional facilities for the production of Morse cutting tools, the available floor space being about 5000 square feet.

CUTLER-HAMMER, INC., 1204 St. Paul Ave., Milwaukee, Wis., has acquired the business of the TRUMBULL VANDERPOOL ELECTRIC MFG. Co. of Bantam, Conn., which will be operated as a subsidiary under its present name. This will add a complete line of meter service and safety switches to the present Cutler-Hammer line of motor control, wiring devices, and similar electrical products.

STERLING GRINDING WHEEL Co., Tiffin, Ohio, held a meeting of the sales and manufacturing organizations of the company on January 30. The plant facilities were inspected by the visiting salesmen and representatives of Sterling agencies. In the evening both organizations attended a banquet, which was followed by a round table discussion of how to accomplish "more and better grinding," at which President H. W. Caldwell presided. The various improvements introduced by the company during the past year were discussed, and ideas and suggestions were presented for further improvements during the coming year.

Salesmen and Representatives who Attended the Sales Conference of the Sterling Grinding Wheel Co. at Tiffin, Ohio

COMMERCIAL TOOL Co., Plymouth Building, 2026 E. 22nd St., Cleveland, Ohio, announces that the Automatic Machine Co.'s line of Coulter automatic machines is now handled exclusively through its office. The line consists of two diamond boring machines, thread milling machines, profiling machine, threading lathes, and a shaping planer, all of which are either full automatic or semi-automatic.

NORTHERN BLOWER Co., W. 65th St. and Barberton Ave., Cleveland, Ohio, who for a number of years has specialized in dust-collecting equipment, is extending its plant by the addition of 75 by 125 feet of manufacturing floor space. The old building, which formerly occupied the space utilized for the new structure, has been torn down. The new building will be of the most modern construction.

APEX MACHINE Co., Dayton, Ohio, announces the following new representatives: Indiana: Thomson Tool & Supply Co., Odd Fellow Building, Indianapolis; Wisconsin: Camm-Blades Machinery Co., 610 Michigan St., Milwaukee. The company has opened its own office in Detroit under the supervision of

David O. Goudie, 5-136 General Motors Building, Detroit, Mich. Mr. Goudie will be assisted by R. W. Ziegler, factory representative and sales engineer.

National Rivet & Mfg. Co., Foot of Park Place, Milwaukee, Wis., has been incorporated for the purpose of manufacturing brass, copper, aluminum, and steel rivets of the solid, semi-tubular, tubular, and split types used for brake-bands and facings for all classes of machinery, airplanes, etc. The new company absorbs the U. S. Rivet & Mfg. Co. of Mishawaka, Ind. The officers of the company are P. H. Dorr, president; and William Fleming, Jr., secretary and treasurer.

Benjamin Electric Mfg. Co., Chicago, Ill., has appointed W. I. Martin exclusive national distributor for its line of safety guards, air ejectors, and unit air compressors used on punch presses. Mr. Martin formerly had charge of the safety device division of the company. His new office will be at 192 N. Clark St. This arrangement does not affect the other Benjamin lines, such as electric lighting, wiring and signalling products, which will continue to be sold through the same channels as at present.

Bonney Forge & Tool Works, Allentown, Pa., has been awarded a certificate by the Daniel Guggenheim Fund for the Promotion of Aeronautics in appreciation of that company's enterprise in placing a large airport identification arrow on the roof of the Bonney building in Allentown, Pa. This document certifies that the work of identification for the service of aerial navigation has been completed in that town, and that Allentown has been officially listed for airport identification on aviation maps.

Prest-O-Lite Co., Inc., 30 E. 42nd St., New York City, has acquired the business of the Acetylene Products Co., which operated two acetylene producing plants located at 401 E. Buchanan St., Phoenix, Ariz., and 914 Texas St., El Paso, Tex. These plants are now being operated as units of the Prest-O-Lite chain. Everett R. Kirkland is superintendent of the Phoenix plant, and Carl F. Chosak is superintendent of the El Paso plant. R. G. Daggett, whose headquarters are at the San Francisco office, is district superintendent.

Amtorg Trading Corporation, 165 Broadway, New York City, announces that V. F. Grachev, general manager of the Krasny-Putilovetz Works at Leningrad, accompanied by three engineers, is in this country in connection with the expansion of the tractor division of the plant, which is to have an annual production of 10,000 tractors and spare parts for 40,000 tractors. These are the largest machine-building works in the U.S.S.R., and at the present time, have an output of 3000 tractors a year, aside from locomotives, passenger cars, dredges, Diesel engines, and textile machinery. The value of the output this year is expected to reach $23,000,000.

Long & Allstatter Co., Hamilton, Ohio, announces that a controlling interest in the company has been acquired by F. E. Goldsmith, president of the Columbia Machine Tool Co. and the Ceramic Machinery Co., both of Hamilton, Ohio, and Frank Yingling, vice-president and treasurer of the same companies. Mr. Yingling has become president of the Long & Allstatter Co.; Paul Long is vice-president; F. E. Goldsmith, treasurer; and L. A. Pfau, secretary and sales manager. The company will continue to develop its line of medium- and large-size bending brakes and punching and shearing equipment, and will also add a line of power presses of the small and medium size, in tie-rod and straight-side types.

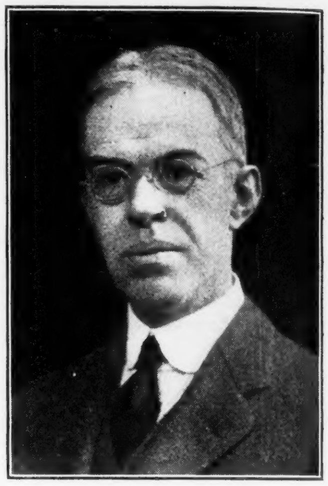
Schauer Machine Co., Cincinnati, Ohio, has been organized to manufacture machine shop equipment. The new company has purchased the assets of the Neil & Smith Electric Tool Co. of Cincinnati, Ohio, which was organized twenty years ago and which has manufactured a line of electric portable drills, electric screwdrivers, nut and lag-screw setters, lathe center grinders, bench and pedestal grinders, and lathe attachments for internal and external grinding. L. Lee Schauer is president and treasurer of the new company; M. J. Byrns, vice-president; and L. C. Christopher, secretary. Mr. Schauer has been connected with the Lodge & Shipley Machine Tool Co. of Cincinnati for the last two years, and previously was with the Cincinnati Bickford Tool Co., for eighteen years. He is a graduate of the University of Cincinnati, and was one of the first students to graduate from the university's cooperative mechanical engineering course.

OBITUARIES

SAMUEL WYLIE MILLER

Samuel Wylie Miller, consulting engineer of the Union Carbide & Carbon Research Laboratories, Inc., of Long Island City, N. Y., well known both in the United States and in Europe as a pioneer in oxy-acetylene welding and an authority on its application, died on February 3 at his home in Hollis, Long Island, N. Y., at the age of sixty-two.

Mr. Miller was a native of New York and received his degree in Mechanical Engineering from Stevens Institute in 1887. His first professional activities were as master mechanic for the Pennsylvania Railroad plants at Logansport, Indianapolis, Ind., and Columbus, Ohio. Following this he was with the American Locomotive Co. at Dunkirk, N. Y. and Providence, R. I., after which he founded the Rochester Welding Works at Rochester, N. Y. During the World War he served on the Welding Committee of the Emergency Fleet Corporation. In 1921, he joined the newly formed Union Carbide & Carbon Research Laboratories, Inc.



Samuel Wylie Miller

In professional circles Mr. Miller was recognized as an able engineer. He was a director and past president of the American Welding Society, a director of the American Bureau of Welding, and chairman of the Oxy-Acetylene Committee of the International Acetylene Association. As a member of the Welding Subcommittee of the Boiler Code Committee he was prominently identified with the American Society of Mechanical Engineers. He was an active member of the American Institute of Mining and Metallurgical Engineers, the American Society for Steel Treating, the British Iron and Steel Institute, the Institute of Metals and other scientific and engineering organizations.

Mr. Miller was instrumental in the development of welding by all processes scientifically well founded, and was noted for his energetic insistence upon high quality and dependable workmanship. He was the donor of the Miller Medal, awarded annually by the American Welding Society for work of conspicuous merit in advancing the art and science of welding. He is credited with having been among the first to visualize the possibilities of the oxy-acetylene process. He contributed a number of articles on welding to Machinery, and was the author of Machinery's book "Oxy-acetylene Welding," as well as of several other books on the subject; he was much sought after as a lecturer on welding at engineering meetings. The loss of Mr. Miller will be keenly felt by the entire engineering and welding profession.

Matthew Griswold, who retired as manager of the Erie (Pa.) Works of the General Electric Co., on January 1, because of ill health, died at his home in Erie on February 10. Mr. Griswold was born in Erie in 1866, and was graduated from Sheffield Scientific School, Yale, in 1888. After two years of post graduate work, he obtained the degree of M. E. Upon leaving college he became associated with the Griswold Mfg. Co., of which he served as president for a number of years. On November 11, 1911, he severed his connection with that company to become acting manager of the Erie Works of the General Electric Co. He was made manager of the plant on December 12, 1912. When Mr. Griswold retired as manager of the Erie Plant on January 1, H. L. R. Emmet succeeded him.

Alexander T. Brown, a well-known inventor, and president of the Brown-Lipe Gear Co., Syracuse, N. Y., died at his home in Syracuse on January 31, aged seventy-five years.

Martin Bergers, purchasing agent for the Clipper Belt Lacer Co., Grand Rapids, Mich., died January 30.

COMING EVENTS

MARCH 14—Twelfth annual meeting of the Electric Hoist Manufacturers' Association at Hotel McAlpin, New York City. E. Donald Tolles, secretary-treasurer, 165 Broadway, New York City.

MARCH 21-23—Regional meeting of the American Society of Mechanical Engineers at Knoxville, Tenn. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

APRIL 8-12—American Foundrymen's Association convention at Hotel Stevens, Chicago, Ill. Headquarters of association, 140 S. Dearborn St., Chicago, Ill.

APRIL 17-19—Sixteenth National Foreign Trade Convention at the Lord Baltimore Hotel, Baltimore, Md. O. K. Davis, secretary, National Foreign Trade Council, India House, 1 Hanover Square, New York City.

APRIL 24-25—Convention of the National Metal Trades Association to be held at the Drake Hotel, Chicago, Ill. J. E. Nyhan, national secretary, Peoples Gas Building, Chicago, Ill.

APRIL 24-26—Annual meeting of the American Welding Society at the Engineering Societies Building, 29 W. 39th St., New York City. M. M. Kelly, secretary, 29 W. 39th St., New York City.

MAY 6-11—Twelfth exposition of the chemical industries to be held at the Grand Central Palace, New York City.

MAY 13-15—Meeting of the American Society of Mechanical Engineers at Rochester, N. Y. Calvin W. Rice, secretary, 29. W. 39th St., New York City.

MAY 16-18—Annual meeting of the American Gear Manufacturers' Association to be held at the Hotel Statler, Cleveland, Ohio. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

JUNE 24-28—Annual meeting of the American Society for Testing Materials at the Chalfonte-Haddon Hall Hotel, Atlantic City, N. J. C. L. Warwick, Secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

JULY 1-4—Summer meeting of the American Society of Mechanical Engineers at Salt Lake City, Utah. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

SEPTEMBER 9-13—Annual convention of the American Society for Steel Treating at Cleveland, Ohio. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

SEPTEMBER 9-13 — Eleventh National Metal Exposition under the auspices of the American Society for Steel Treating at the Cleveland Public Auditorium, Cleveland, Ohio. For further information address W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

SEPTEMBER 30-OCTOBER 4—Machine Tool Exposition held by the National Machine Tool Builders' Association in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, Provident Bank Building, Cincinnati, Ohio.

CALENDARS RECEIVED

REVOLVATOR CO., 343 Garfield Ave., Jersey City, N. J., manufacturer of portable and stationary elevators, "liftrucks," and storage racks, is distributing a calendar to the trade, which pictures some applications of the material-handling equipment made by this concern.

GARLOCK PACKING CO., Palmyra, N. Y., manufacturer of mechanical packings for valve stems, piston-rods, centrifugal pumps, and general service packing, is distributing a large wall calendar, showing three months on each sheet as well as various applications of Garlock packing.

NEW BOOKS AND PAMPHLETS

MEASUREMENT OF PIPE FLOW BY THE COORDINATE METHOD. By F. W. Greve. 31 pages, 6 by 9 inches. Published by Purdue University, Lafayette, Ind., as Bulletin No. 32 of the Engineering Experiment Station.

COATED ABRASIVE PRODUCTS. 20 pages, 6 by 9 inches. Published by the Department of Commerce, Washington, D. C., as Simplified Practice Recommendation No. R89-28 of the Bureau of Standards. Price, 10 cents.

HOW TO BRONZE-WELD CYLINDER BLOCKS. 11 pages, 6 by 9 inches. Distributed by the Linde Air Products Co., 30 E. 42nd St., New York City.

This little pamphlet describes the repairing of cast-iron cylinder blocks by bronze-welding using the oxy-acetylene process. It discusses preparation for welding, welding a cylinder block in place, equipment required, and the welding operation.

ROLLED STEEL PLATES FOR COLUMN BASES. 17 pages, 5 by 7½ inches. Published by the Carnegie Steel Co., Subsidiary of the United States Steel Corporation, Pittsburgh, Pa.

This pamphlet gives recommended widths and thicknesses, rolling and cutting tolerances, extras for cutting to length, weights per linear foot, and sizes required for various sizes and weights of Carnegie beam sections.

PROCEEDINGS OF THE THIRTY-FIRST ANNUAL MEETING OF THE AMERICAN SOCIETY FOR TESTING MATERIALS. Published in two parts; Part I, 1184 pages, 6 by 9 inches; Part II, 904 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. Price for each part, $6, bound in paper; $6.50, in cloth; and $8, in half-leather binding.

Part I of the proceedings contains committee reports and new and revised tentative standards. Part II contains forty-six technical papers presented before the meeting, with discussion.

MECHANICAL WORLD ELECTRICAL BOOK (1929). 338 pages, 4 by 6 inches. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price 1/6, net.

This is the twenty-second edition of a little handbook containing a collection of electrical engineering notes, rules, tables, and data. A large amount of new matter has been added in the present edition relating to heavy electrical engineering. Much of the matter in the early sections has been rewritten and extended to cover direct-current generators, direct-current motors, synchronous motors, induction motors, auto-synchronous and synchronous-induction motors, and traction motors. Further additions include a section on automatic sub-stations, and a page of data relating to condenser calculations.

THE ABC OF AVIATION. By Victor W. Page. 143 pages, 5 by 7 inches. Published by the Norman W. Henley Publishing Co., 2 W. 45th St., New York City. Price, $1.

This little book has been prepared to meet the demand for a simple work in everyday language defining the principles governing flying machines and airships. The book has been especially prepared by an aviation expert for the benefit of young people and non-technical readers who wish a reliable introductory treatise to the study of aeronautics. While the matter is presented in the form of a popular discussion, general in scope, the reader will have no difficulty in obtaining a good basic knowledge of various aircraft types and why they fly. The illustrations show leading types of airplanes, and many explanatory diagrams are included to make the underlying principles clear.

GLUE FOR POLISHING—A Treatise on the Use and Treatment of Glue for Polishing. By Bradford H. Divine, president of the Divine Bros. Co., Utica, N. Y. 31 pages, 5 by 7 inches. Published by the Divine Bros. Co., Utica, N. Y. Price, 50 cents.

The information in this book has been published with a view to giving those interested in glue for polishing work the benefit of the author's many years' experience in this field. The author has devoted more than thirty years to the manufacture of machines, tools, and equipment for the abrasive metal-finishing industry. His intimate contact with the application of glue and abrasive to the various kinds of polishing wheels manufactured by him, and the general lack of knowledge of the importance of glue in polishing work, has turned his attention to the study of this important subject. The results of his experience and experiments are recorded in this treatise.

NEW CATALOGUES AND CIRCULARS

DRILLS. Morse Twist Drill & Machine Co., New Bedford, Mass. Leaflet describing the drilling of manganese steel with a Morse Circle C cobalt steel drill.

GEARS. Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio. Catalogue 29, listing Ohio stock gears, ready for delivery in twenty-four hours after receipt of order.

WHEEL TRUING TOOLS. Ross Mfg. Co., Cleveland, Ohio. Circular describing the details of construction of the Ross "Senior" truing tool for cylindrical grinders.

TUBE COUPLINGS. Parker Appliance Co., 10320 Berea Road, Cleveland, Ohio. Leaflet illustrating Parker tube couplings and the method of using Parker flaring tools.

STEEL CASTINGS. Lebanon Steel Foundry, Lebanon, Pa. Circular entitled "Where a Break-down Would Lose a Fortune" illustrating the use of Lebanon steel castings in oil fields.

MOTORS. Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. Bulletin 158, on small vertical motors, covering all types and ratings of from 1/6 to 1½ horsepower.

GRINDING MACHINES. Rivett Lathe & Grinder Corporation, Brighton, Boston, Mass. Bulletin 104-A, describing the details of construction of the Rivett No. 104 internal grinding machine.

ELECTRIC CONTROL EQUIPMENT. Monitor Controller Co., Baltimore, Md. Bulletin 113, describing in detail the features of construction of Monitor alternating-current automatic starters.

ELECTRIC CONTROL EQUIPMENT. Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, Ohio. Circular descriptive of a new EC & M system of direct-current magnetic contactor control for steel mill service.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletin GEA-1031A, illustrating and describing G-E type AW resistor arc welders for metallic welding, mining service, and electric railway work.

FACTORY HEATING. L. J. Wing Mfg. Co., 154 W. 14th St., New York City. Bulletin outlining briefly the history and development of "unit heating," and giving the essentials necessary for good factory heating.

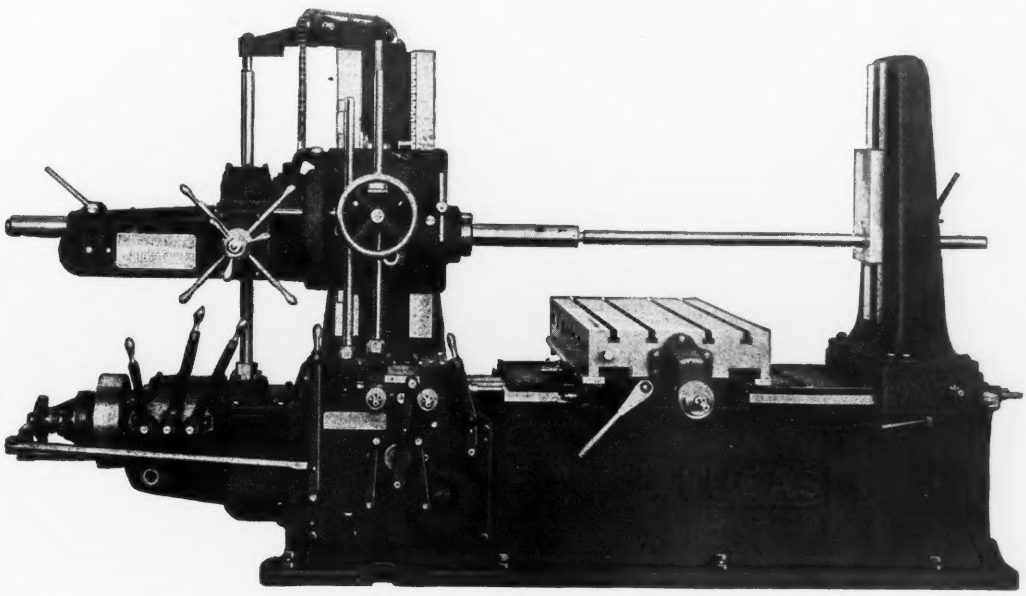
MATERIAL HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Bulletin illustrating the use of the Cleveland tramrail system in ovens and dryers.

WIRE STRIPPER. Weber Machine Corporation, 33 S. Water St., Rochester, N. Y. Circular descriptive of the "Perfection" wire stripper, which is designed to enable insulation to be removed from wire on a production basis.

MEASURING TOOLS. Swedish Gage Company of America, Detroit, Mich. Catalogue of precision measuring tools, including micrometers, adjustable limit snap gages, inside indicator gages, and automatic centering drill chucks.

TRUCKS. Lewis-Shepard Co., Watertown, Mass. Bulletin illustrating the single-stroke lift truck made by this concern, which has an effective lifting range of 180 degrees. Specifications of the two types in which this truck is made are included.

Quality Must Be Paramount—
We Do No Trading on Past Reputation



The Quality of the

"PRECISION"

Boring, Drilling and MILLING MACHINE

is not only kept up, but improved whenever possible.

WE ALSO MAKE THE
LUCAS POWER
Forcing Press

The new model 3″ spindle No. 41 Machine is illustrated and described with detailed specifications in circular A-40.

Circular B-2 pertains to the larger size No. 42 and No. 43 Machines with 4″ and 5″ spindles.

May we tell you about the many advantageous features of these improved machines?

THE LUCAS MACHINE TOOL CO., Cleveland, Ohio, U.S.A.

FOREIGN AGENTS: Allied Machinery Co., Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm. R. S. Stokvis & Zonen, Paris and Rotterdam. Andrews & George Co., Tokyo. Ing. M. Kocian & G. Nedela, Prague. Emanuele Mascherpa, Milan, Italy.

NICKEL ALLOY STEEL. International Nickel Co., Inc., 67 Wall St., New York City. Bulletin describing performance characteristics and important features of design of the Curtiss D-12 and Conqueror airplane engines, and their use of nickel alloy steel.

TRIPLE DIE STEEL. Firth-Sterling Steel Co., McKeesport, Pa. Booklet on "Cromovan" triple die steel, a new type of high-production die steel especially suitable for use in stamping plants where the runs are very long, and for automobile bodies and parts.

DRILLING AND TAPPING HEADS. Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich. Bulletin describing the construction of this company's line of multiple ball-bearing drilling and tapping heads. The details are made clear by large-scale line drawings.

BELTING. E. F. Houghton & Co., Philadelphia, Pa. Bulletin entitled, "About Rivets and the Like," by Charles E. Carpenter, president of E. F. Houghton & Co., discussing leather belting joined by rivets, as compared with Vim leather belting in which no rivets are used.

CUTTER GRINDERS. Ingersoll Milling Machine Co., Rockford, Ill. Folder briefly describing and illustrating the Ingersoll cutter grinder, which is particularly designed for grinding face mills. The circular also illustrates a fixture for checking the accuracy of the cutter grinding.

CIRCUIT BREAKERS. Roller-Smith Co., 233 Broadway, New York City. Supplement No. 1 to Bulletin 580, describing Roller-Smith enclosed circuit breakers, designed for the protection of motors and feeder circuits against overload and failure of voltage. Capacities and price lists are included.

POWER TRANSMITTING APPLIANCES. Standard Pressed Steel Co., Jenkintown, Pa. Catalogue containing data on "Pioneer" steel shaft hangers, wall brackets, girder clamps, bearings, pillow blocks, couplings, countershaft hangers, etc. Dimensions and price lists of the various products are included.

SHEARS. Canton Foundry & Machine Co., Canton, Ohio. Catalogue illustrating and describing in detail the construction of Canton all-steel double-geared alligator shears, which are made in both high and low knife types, right or left hand, belt and motor driven. Specifications are given for the various sizes.

INDICATING AND CONTROLLING EQUIPMENT. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Circular No. 14 of a heat-treating series, dealing with the tempering of 4000 saw teeth per hour at the Disston plant by the use of a Homo tempering furnace equipped with automatic control.

GAS PUMPS. P. H. & F. M. Roots Co., Connersville, Ind. Bulletin 33-B1 on high-pressure type rotary gas pumps. The bulletin gives complete tabulated data on pressures, capacities, and horsepowers, a brief review of various types of pumping units, and a two-page construction drawing showing the typical unit in detail.

SELF-TAPPING SCREWS. Parker-Kalon Corporation,, 200 Varick St., New York City. Pamphlet entitled "The Evolution of the Screw," tracing the development of the screw from the earliest stages up to the present time. The last part of the bulletin is devoted to brief descriptions of the various types of self-tapping screws made by this company.

STEEL CASTINGS. Geo. H. Smith Steel Casting Co., Milwaukee, Wis. Catalogue entitled "The Story of Smithco Steel Castings," containing a brief historical outline of the development of the company, a statement of its policies, and illustrations and descriptions of the various departments and the processes employed in the production of electric steel.

MILLING MACHINES. Oesterlein Machine Co., Cincinnati, Ohio. Catalogue of the Oesterlein 28- and 48-inch tilted offset millers. The offset principle is described and instances of production savings by this method are given, after which follows a detailed description of the construction of these machines. Production data for various typical jobs are included.

STEEL OFFICE AND FACTORY EQUIPMENT. Angle Steel Stool Co., Plainwell, Mich. General catalogue C, containing 112 pages illustrating and describing the complete line of Angle Steel equipment for factory and office made by this company. The equipment shown includes stools and chairs, desks, cabinets, lockers, steel shelving, bins, tables, bench legs, trucks, etc.

HOISTS. Stephens-Adamson Mfg. Co., Aurora, Ill. Catalogue descriptive of the features of construction of the SA skip hoists for the high-speed hoisting of bulk materials. Typical installations of these hoists are illustrated, and lay-outs of typical arrangements are shown. The line of skip buckets obtainable for skip hoist installations is also illustrated and described.

BLANCHARD PULSATING LUBRICATING SYSTEM. Rivett Lathe & Grinder Corporation, Brighton, Boston, Mass. Circular describing in detail the Blanchard pulsating system for oil lubrication, illustrated with line engravings which clearly show the mechanical details. Reprint of an article published in MACHINERY describing the Blanchard pulsating system.

MILLING MACHINES. Kearney & Trecker Corporation, Milwaukee, Wis. Catalogue 36, describing Mil-waukee-Mil production milling machines. The plan of unit construction employed in these machines is explained, and complete details regarding the features of design, as well as specifications and shipping data are included. One section of the catalogue shows these machines at work on various typical jobs.

HEAT-TREATING FURNACES. American Gas Furnace Co., Spring and Lafayette Sts., Elizabeth, N. J. Reprint of an article entitled, "Furnaces for Various Heat-treatments," published in *Heat Treating and Forging*. The article is divided into three parts dealing, respectively, with oven type and vertical cylindrical type furnaces and the use of salt baths; casehardening problems; and various types of heating machines.

BELTING. Charles A. Schieren Co., 73 Ferry St., New York City. Pamphlet entitled "Power Belt Ratings Under Unusual Operating Conditions," by Roy C. Moore, discussing various conditions affecting the power-transmitting capacity of belting and the points to be considered in laying out efficient and economical belt drives. This bulletin is the sixth of a series entitled "The Seven Factors of Belting Economy."

ELECTRIC EQUIPMENT. Cutler-Hammer Mfg. Co., 1204 St. Paul Ave., Milwaukee, Wis. Bulletin entitled "Modern Valve Control Practice," describing the C-H automatic valve control system. This is the second edition of this bulletin, and much additional information and data have been included. Many new photographs show the use and installation of motor-driven valves in power plants, water works, gas plants, etc.

WIRE-FEED SCREW MACHINES. Brown & Sharpe Mfg. Co., Providence, R. I. Bulletin on a new line of B & S wire-feed screw machines, arranged for motor drive only. The machines are designed for economical production on short runs and job lots. They are made in three sizes. Nos. 0, 1, and 2, of the same capacities as the corresponding sizes of belt-driven wire-feed screw machines. The bulletin describes the special features of the motor-driven type.

BELTING. L. H. Gilmer Co., Tacony, Philadelphia, Pa. Handbook of small belt drives. Among the subjects discussed are: When to Use a Belt Drive; Belts for Cone Drive; Construction and Characteristics of the V-belt; Fundamental Principles of Belt Drives; Designing Belt Drives; Horsepower Ratings of Gilmer V-belts; Correction Factors for Various Arcs of Contact; Table of Belt Ratings; Formulas Relating to Belt Drives; and How to Order a V-belt.

LAPPING AND FINISHING COMPOUNDS. Carborundum Co., Niagara Falls, N. Y. Booklet entitled "Carborundum Brand Finishing Compounds," describing newly developed lapping and finishing compounds placed on the market by the company, and giving detailed instructions for the selection of compounds suitable for different classes of work, such as soft and hardened metallic gears, non-metallic gears, split and solid bearings, crankshaft pins, dies, and gages, ball bearing raceways, worms, and worm-wheels.

LATHES. Rivett Lathe & Grinder Corporation, Brighton, Boston, Mass. Bulletin 505-A, illustrating and describing the Rivett plain precision bench lathe No. 505 and attachments. Bulletin 507-A, descriptive of the Rivett Junior bench lathe No. 507. Complete specifications of the lathe and attachments are included. Bulletin 608-A, illustrating and describing the Rivett precision back-geared screw cutting lathe No. 608. The bulletin describes methods of mounting and driving and shows applications of the various attachments.

SPEED REDUCERS. Gears and Forgings, Inc., Cleveland, Ohio. Bulletin B, describing in detail the construction and range of uses of the G & F planetary line of speed reducers. Bulletin C, descriptive of G & F worm-gear speed reducers, giving details of construction, tables of ratings, and applications. These bulletins give complete specifications for these two lines of speed reducers as well as information regarding the fields for which they are especially adapted. Those interested in this class of equipment can obtain copies upon request.

VARIABLE-SPEED TRANSMISSION. Reeves Pulley Co., Columbus, Ind. Booklet entitled "The Modern Need for Infinite Speed Adjustability." The purpose of this booklet is to conduct the reader on a brief inspection tour into the factories of fifteen nationally known manufacturers of diversified products, and to describe the method by which they have solved problems in speed regulation. Among the plants shown are the Anaconda Copper Mining Co., E. C. Atkins & Co., Atwater Kent Mfg. Co., Ford Motor Car Co., Johns-Manville Corporation, and many others.

AUTOMATIC MACHINERY. Bullard Machine Tool Co., Bridgeport, Conn. Treatise entitled "The Mult-Au-Matic Method," describing in considerable detail the principles involved in the methods of machining used in connection with the Bullard Mult-Au-Matics. The treatise covers 75 pages, 8½ by 11 inches, and is profusely illustrated with halftone engravings. Many examples are given of the production obtained on Mult-Au-Matics, and many interior views from shops where these machines are in operation are included. The treatise is a fine example of the printer's art.

POLISHING AND BUFFING EQUIPMENT. Divine Bros. Co., Utica, N. Y. Catalogue entitled "Abrasive Metal Finishing," giving information relating to buffing wheels; compress polishing wheels; disk canvas, clothflex, wool felt, solid felt, paper and sheepskin polishing wheels; belts for sanding and polishing; polishing wheel hubs; Tampico wheels; glue; glue heaters; balancing stands; wheel dressing machines; and other polishing room equipment. This catalogue is more than a list of equipment and specifications, —it is really a treatise on polishing and buffing and a fine example of the printer's art, being produced in two colors on buff coated paper.

CHAIN DRIVES. Morse Chain Co., Ithaca, N. Y. Bulletin 35, covering sprockets and chain which are carried in stock in the following localities: Carolina Supply Co., Greenville, S. C.; Crago Gear Co., Kansas City, Mo.; Dodge-Newark Supply Co., Newark, N. J.; James Supply Co., Chattanooga, Tenn.; Moore-Handley Hardware Co., Birmingham, Ala.; Morse Chain Co., Detroit, Mich.; Morse Chain Co., Ithaca, N. Y.; and Tranter Mfg. Co., Pittsburg, Pa. The bulletin is arranged in such a way that the customer may select two or three different designs to meet his specifications. Drives from 1 to 25 horsepower can be shipped within forty-eight hours, bored and keyseated to fit the customer's shafts.